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ENGINEERING AND MINING JOURNAL

A Consolidation of Engineering and Mining Journal and Mining and Scientific Press

METAL AND NON-METALLIC MINING · MILLING · SMELTING · REFINING · MARKETING

AN EXCURSION INTO ROUYN-II

The Horne, Amulet and Waite-Montgomery Properties

By Arthur Barrette Parsons

KENTUCKY-ILLINOIS ORE-MAGMATIC DISTRICT-II

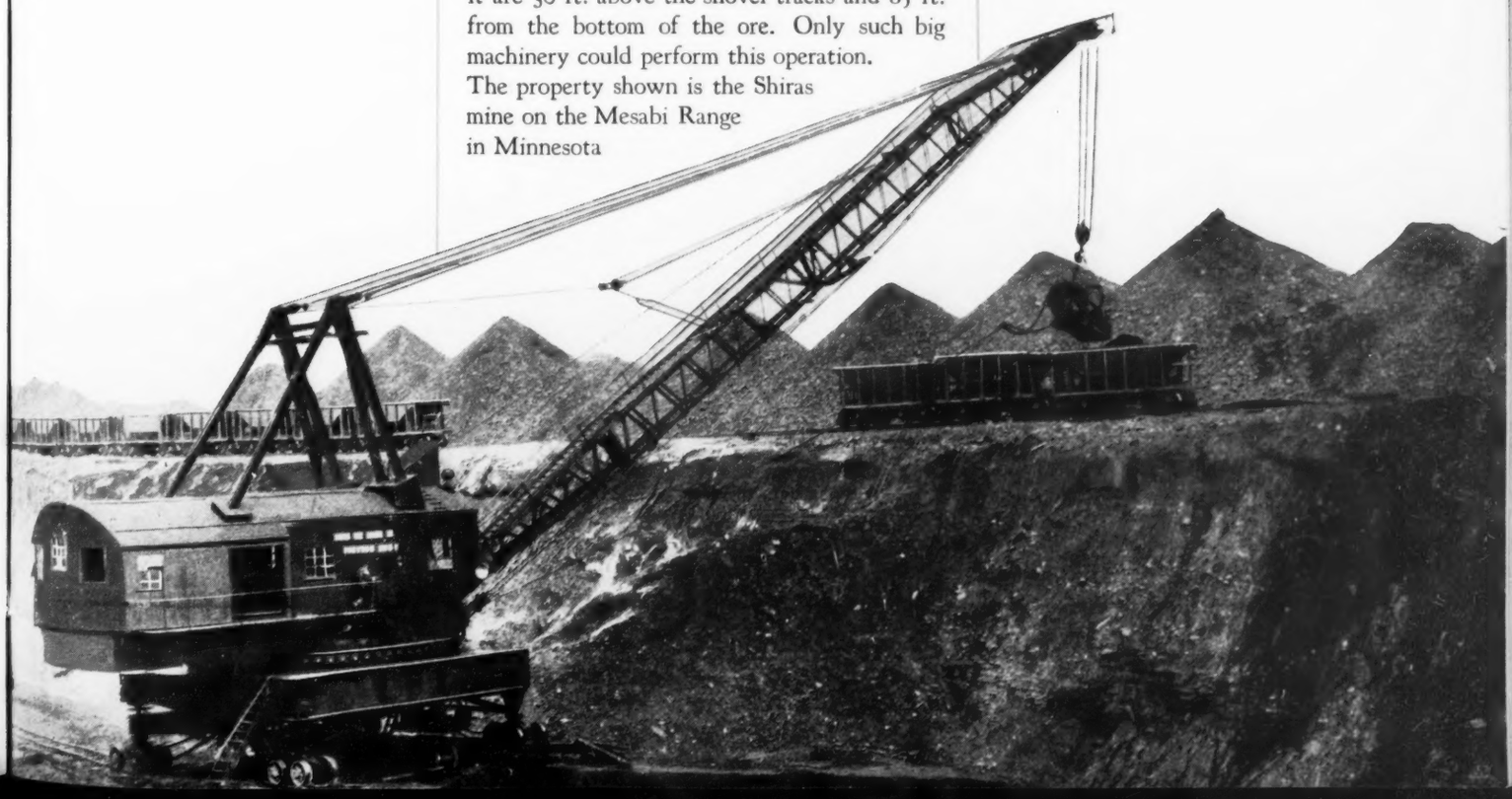
By J. E. Spurr

USEFUL OPERATING IDEAS

Working Model of a Skip Dump—Ball, Roller and Plain Bearings—Repairing a Roll Fly-Wheel Pulley—Portable Protecting Screens—A Stock Pile Crane

AN UNUSUAL IRON ORE OPERATION

THE electric dragline, with its 150 ft. boom and 5 yd. bucket, stands on the end of a long narrow orebody which it has completely exposed by stripping in a pit 1500 ft. long and 200 ft. wide from crest to crest. The cars that it is loading from the ore below it are 30 ft. above the shovel tracks and 85 ft. from the bottom of the ore. Only such big machinery could perform this operation. The property shown is the Shiras mine on the Mesabi Range in Minnesota



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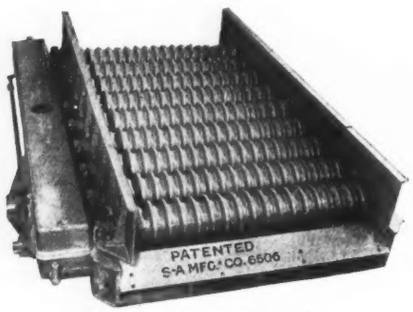

The S-A Live Roll Grizzly

Sixth—The increasing speed of each successive spool serves to thin out the load as it passes over this grizzly.

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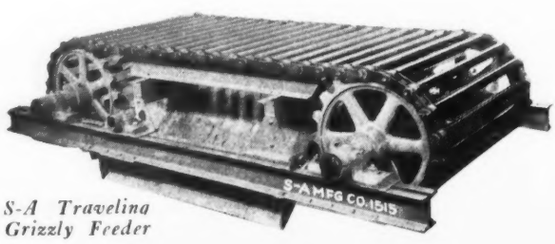

S-A Traveling Grizzly Feeder

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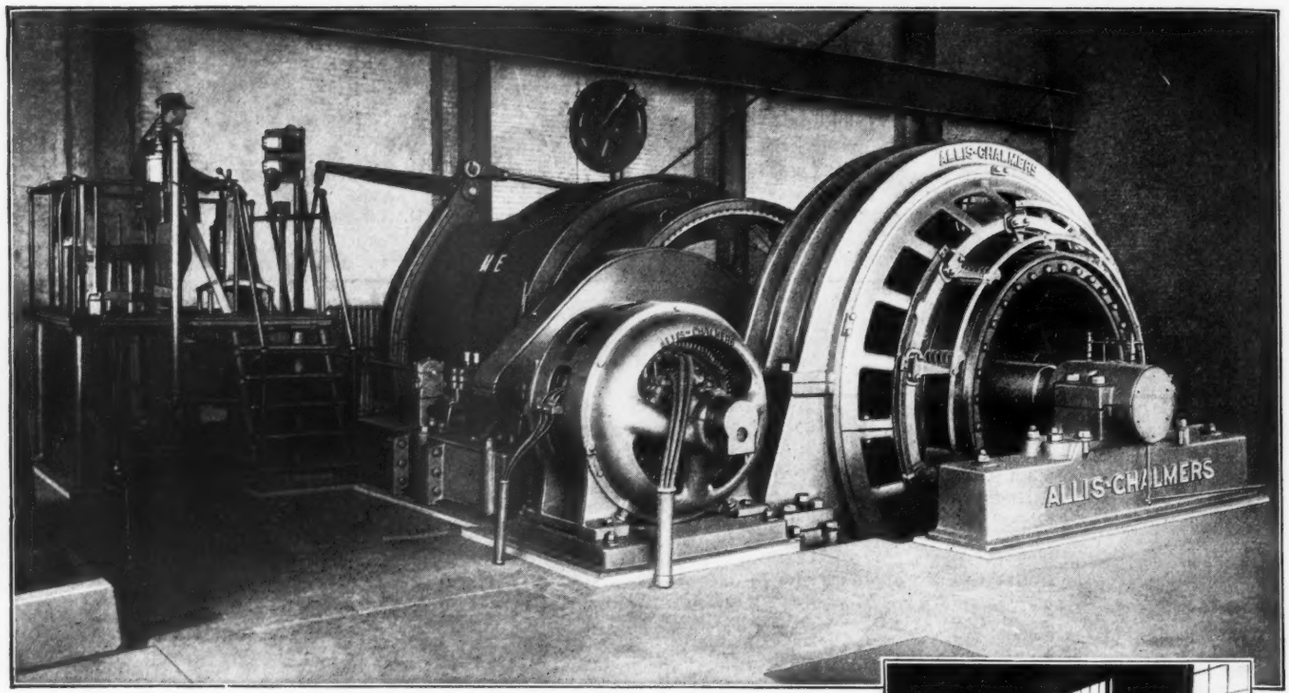

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ENGINEERING AND
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JOSIAH EDWARD SPURR, Editor

Volume 122 New York, November 6, 1926 *Number* 19

Publication an Aid to Inventors

PUBLICATION of descriptions of new processes and new equipment is often requested to be withheld, for the reason that no disclosure is desired until after patent protection is granted, it apparently being felt that if a description were printed some one else might secure a patent before the original discoverer. This matter has been placed before a lawyer, who gives it as his opinion that it would ordinarily be a benefit to an inventor to have a description of his work published, rather than otherwise. Thus is a date established; and should any one else apply for a patent it would be necessary for him to show that his discovery antedated that disclosed in the publication. For example, in the recent Carson case, the literature was carefully searched to see if any reverberatory furnace employing side-feeding was described before Carson applied for his patent. Had such publication been found, the smelting companies would have been saved great trouble and expense.

It is necessary, however, for application for patent to be made within two years after publication; otherwise, the device or process becomes public property. Therefore, if it is expected that more than two years will be required to develop a process before patent application can be made, it would be unwise to publish any preliminary details. The only other untoward result that might follow is that some one else might get an idea or inspiration from the new work that would result in still further improvement, which, of course, he would be privileged to patent. This, however, would make for progress, and would not interfere with the patenting of the original invention.

Therefore, it would appear that there need be no hesitation in permitting the publication of descriptive details of new work. If there is no intention of taking out a patent, such publication will prevent some one else from doing so, and will eliminate the necessity of securing a patent for protection only. And if a patent is desired, it will be to the interest of the prospective patentee to have some reference to his work on record in the literature. Of course, he must be prepared to prove that his invention antedates a competing claim, should one be offered.

The Belgian Franc Stabilized

THE STABILIZATION of Belgian currency on a gold basis is properly hailed as a step toward further rehabilitation and toward a sounder trade activity and general prosperity. In the reports and editorials on the subject the tone is invariably approving, as if Belgium had finally extricated herself with credit from the financial situation into which the war had put her. Indeed, all honor to Belgium, ruthlessly invaded and devastated. The war was not of her wishing, nor the economic disaster avoidable.

Nevertheless, one should not forget that the stabilization of the former gold franc at 2.78c. is a legal declaration of bankruptcy. The money which the nation borrowed in gold francs worth 19.3c., it decides it will repay to the extent of only 2.78c.—that is at the rate of 14.4c. to the dollar. To visualize the situation in the United States, let us suppose that after we bought Liberty Bonds during the war our government had been forced to flood the country with paper—ostensibly upon a gold basis, but in such volume that the purchasing power grew continually less: now, eight years after the war, the United States announces that a $1,000 Liberty Bond is permanently worth $144 in gold.

Government bonds, though the government's chief concern, are really a minor phase of this dilution and subsequent pegging of the currency. Suppose a school teacher had accumulated before the war $20,000, which she had invested in the best investments possible—in gilt-edged bonds and mortgages, with an income of $1,000 annually, against her old age; her principal now, through the "stabilization," is fixed at $2,880 and her annual income is $144, although living costs are higher than before the war. This is an example of what has happened to the thrifty classes, the old and dependent, the institutions of Belgium. The people of the United States are fortunate that this has not come to them: it is the usual thing in Europe. In many countries paper currency was allowed to run down till worthless: then the government paid nothing whatever on its internal debts; and the $20,000 investment of our school teacher became zero. This happened in Germany, in Russia, in Austria. Among the principal actually belligerent nations of Europe, only England regained her ability to repay gold dollar for gold dollar.

France has drifted down the same road to bankruptcy with Belgium; but she lacks the heroic spirit of Belgium to face the disaster. Premier Poincaré points out that he is in no hurry to "stabilize"—the longer he waits, the less he will have to pay! Also, there are 10,000,000 Frenchmen who are living on incomes from depreciated bonds, who hope against hope that the franc will appreciate, so that their incomes will increase instead of being fixed at a small fraction of the pre-war figure. It is a characteristic unwillingness to face the issue, similar to the attitude toward the external debts of France. Most European countries, in going through this type of bankruptcy, paying something or nothing on the dollar, regain, like any declared bankrupt, their financial standing and ability to borrow, especially abroad; but France's indecision as to declaring her ability to pay her own citizens extends to what she owes abroad. The sooner the plunge is taken, the better: Europe, once on a stable currency, will revive rapidly, as has been shown to be the case in those countries which have stabilized. And with this revival comes the greater need for metals, and greater prosperity for the mining industries.

Progress at Golden

IT WAS NATURAL that the Colorado School of Mines should have been well represented at the mining convention recently held in Denver. Mere numbers would have been easy to produce by reason of its proximity. Of more importance than numbers were the two prominent members of its staff who made material contributions to the program. Dr. M. F. Coolbaugh, the school's new president, and A. J. Weinig, superintendent of the State Experimental Plant, situated at the school, both of them prominent metallurgists, discussed important subjects. The progress of hydrometallurgy was sketched by Doctor Coolbaugh and the important rôle of selective flotation by Mr. Weinig. Neither address was intended particularly for metallurgists, and both were clear and instructive to the mining men of varied sort that made the audience.

Conditions have changed at Golden. Much of the difficulty that impeded the progress of the school was removed with the succession of Doctor Coolbaugh to its directorship. Improvements in courses and additions to the teaching personnel now make the school more attractive to entering and graduate students. Of especial note in this regard is the new course in geophysics to be given by Dr. C. A. Heiland, until recently of Berlin, who is already known to *E. & M. J.* readers through his writings on the subject.

Supreme Court Limits the Right to Strike

A RECENT DECISION by the U. S. Supreme Court in the case of Mackie Fuel Co. vs. Dorchy limits the right to strike to matters concerning contractual relations, expressed or implied, between employer and employee. The case is one that developed under the Kansas Court of Industrial Relations wherein Dorchy was found guilty of violating Section 19 of the Industrial Relations Court Act, which section makes it a crime for an officer of a labor union to use the power and influence of his position to induce another person to violate any part of that act.

The cause of the strike was a personal one—one in which a miner named Mishmash claimed the corporation owed him $180 not shown on the corporation's books. Mishmash was not an employee of the company at the time the strike was called, although he was an ex-employee and a member of the local union. The strike was called by Dorchy and associates to enforce payment of the Mishmash claim. The miners did not resume work until the claim was paid. In the meantime the mining company suffered injury and loss, and instituted suit against Dorchy, with the result that he was convicted and sentenced to fine and imprisonment. He appealed on the ground that Section 19 undertook to prohibit strikes and thereby violated the personal liberty due process clause of the Fourteenth Amendment. The higher state courts upheld the decision, which was in turn appealed to the U. S. Supreme Court and again sustained.

In his summary of the case Justice Brandeis says that this strike was not called because of a trade dispute or as a sympathetic strike. In his opinion the differences between Mishmash and his former employers could have been adjusted by ordinary legal machinery. Justice Brandies then uses the following language:

"The right to carry on business—be it called liberty or property—has value. To interfere with this right without just cause is unlawful. The fact that the injury was inflicted by a strike is sometimes a justification. But a strike may be illegal because of its purpose, however orderly the manner in which it is conducted.

"To collect a stale claim due to a fellow member of the union who was formerly employed in the business is not a permissible purpose. In the absence of a valid agreement to the contrary, each party to a disputed claim may insist that it be determined only by a court.

"To enforce payment by a strike is clearly coercion. The Legislature may make such action punishable criminally, as extortion or otherwise. And it may subject to punishment him who uses the power or influence incident to his office in a union to order the strike. Neither the common law nor the Fourteenth Amendment confers the absolute right to strike."

America's Largest Gold Camp

IN ROUND NUMBERS the mines of the Porcupine area, in northern Ontario, are producing 280,000 tons of gold ore, yielding $8 per ton, each month. This is a yield of $2,240,000 monthly, or $26,880,000 annually; measurably more than the two leading gold-producing states in the United States—California, Colorado—and the territory of Alaska aggregated in 1925. Hollinger, of course, accounts for about three-fifths of the output; still, Porcupine is by no means a one-mine district. No fewer than seven others contribute to production; these include McIntyre, Dome, Vipond, Ankerite, March Gold, Paymaster, and West Dome Lake, each of which has a mill and cyanide plant with a capacity of 100 tons or more per day. Two of these plants—those of the Ankerite and Paymaster—are new; they are modern in every respect; and, like the others in the district, are giving good recoveries.

A daily output of 9,350 tons of ore does not perhaps loom particularly large in a mind accustomed to thinking of single mines producing 20,000 or even 36,000 tons of ore per day. But it must be remembered that these Porcupine orebodies are not huge masses worked either by steam shovel or by low-cost underground caving methods. The veins are comparatively narrow, the ore is hard rather than soft, and every ton is won by drilling and blasting holes 6 to 10 ft. deep. It is estimated that 12,000 pieces of drill steel are sharpened every day, and that 600 drill-machine shifts are put in. About 400 ft. of sinking, raising, crosscutting, and drifting is done each day; and the ore is ground so that 85 per cent or more will pass 200 mesh. The payrolls, exclusive of salaried men, aggregate about 4,700 workers. These figures give some idea of the size and importance of the Porcupine gold-mining industry today.

But the most remarkable feature is that the prospect for the future is still further expansion. Hollinger is averaging a little better than 5,500 tons of ore per day; three new ball mills and other necessary machinery have been ordered to increase the capacity of the mill—already adequate in most departments—to 8,000 tons. The equipment on the lower levels of the mine is designed to handle this tonnage, and it is only a question of time—maybe a year or possibly two years—when Hollinger will be producing at the rate of 8,000 tons per day.

When A. F. Brigham, Hollinger's manager, talked about expanding from 2,500 to 3,500 tons, many thought he was joking. Later when he talked of 5,000 tons, the wise ones shook their heads. But on occasion 6,000 tons has been milled in a single day! Mr. Brigham is a man of capacity and imagination as well as determina-

tion (he has even been called stubborn by his admirers), and the 8,000-ton program is pretty sure to be realized. Will the mill heads drop materially? Eventually, but probably not at once, is a good guess. Not even Mr. Brigham really knows.

Over at the McIntyre, regarded as the inheritor of several of the rich Hollinger oreshoots on their pitch, the present mill is straining to handle 1,350 tons per day. The company, under the competent guidance of R. J. Ennis, the general manager, is now sinking a large five-compartment shaft a quarter mile east of the present main shaft. This is expected to reach 4,000 ft. next March, and active development will be undertaken to verify the conclusions already based on diamond-drill holes and other data. The program then probably will be either to build an entirely new mill of about 4,000-ton capacity near the new shaft or to double the capacity of the existing plant at the present site on the opposite side of the lake. The decision will depend on the outcome of development. In any event the output of the McIntyre ought to be at least doubled within a comparatively few years.

The Dome mine, oldest of the producers, is expected to decrease its output rather than expand; but big gold mines are prone to die slowly, and Dome may be turning out bullion for years to come. Vipond, managed by Robert Dye, recently has doubled its mill capacity, and the outlook is regarded as encouraging. With respect to the smaller properties, it may be said that the development of a big mine is always possible. The Paymaster is working on an extremely low-grade ore, but has in its favor the fact that the ore zone is wide, the gold presumably being associated with pyrite disseminated in the mass. Whether the company will be able to make any profit remains to be seen.

Porcupine mines, as a whole, are in the hands of high-caliber men; the metallurgists are progressive and competent, and they are willing to co-operate in the solution of their common problems. As time goes on, costs of operation should be reduced, and the minimum tenor of profitable ore should be lessened; or, on the other hand, the margin of profit on better ores widened. That the veins are numerous, long, and persistent is generally admitted. Every evidence points to a thriving future for America's largest gold-mining camp.

A Golden Miracle

ONE of the journals of misinformation for the common peepul, which (the journals) abound in New York, prints a tale of a volcano in Kertsch, Russia, which burst forth, covering with volcanic dust and destroying the farms. But when the peasants returned, weeping, they found (the report says) that the dust contained gold: so now they are praying for another eruption.

Clearly the age of miracles is not past: and if anybody needed such a manifestation of special generosity, no doubt it is the Russian peasant. But the Russian peasant is a hopeless dolt, even as Tolstoi would have us believe—for instead of gathering up the gold, he prays for another eruption. Probably the first eruption was low-grade dust, and they are kicking for high-grade. Let them beware: when the eruption comes it may be plain rock dust. Better sell a concession to the United States, if they do not know how to handle the situation with their wooden gold-pans.

The Value of Exchanging Ideas

THIS IS AN AGE OF PUBLICITY, and publicity has its virtues as well as its faults. The sensational newspaper, flaunting before a morbid public the details and pictures of crime, tends to promote rather than to cure crime; but, on the other hand, there is in the world a vast amount of healthy publicity that tends to increase human knowledge, and to place at the disposal of each industry the accumulated knowledge gained in various other fields of human endeavor. This latter tendency accounts for much of the progress now being made in the mining industry. A condition has existed very generally in the past, and unfortunately still persists in some quarters, whereby one branch of a mining industry was self-sufficient, developed its own equipment, and worked out its own methods, both of which it guarded jealously from the knowledge of competitors and others. Gradually the conviction has grown that benefits extended to an entire industry commonly bring an unexpected harvest to each individual member.

Recently the Bureau of Mines has developed a modified type of sintering machine suitable for the manufacture of limestone spalls into lime, a highly desirable process, for thousands of tons of spalls now go to waste. The sintering machine is a standard type of equipment, well known in various branches of the metal-mining industry, but is practically unknown in the stone industries. The federal bureau, representing both the metals and the non-metals, has, as a result of many tests, been enabled to point out to the lime industry how it may, with some necessary modifications, adapt to its needs a type of equipment representing ideas that have grown to maturity through years of invention and experimentation in an unrelated field. In like manner the same bureau has applied to the milling of fluorspar the knowledge gained from years of study in the Tri-State zinc and lead district, with the result that fluorspar mills are being remodeled, and much better recovery is made.

Many other improvements in equipment and economies in operation could no doubt be accomplished if the exchange of ideas were further encouraged. Both the examples cited represent the non-metallics as deriving benefits from the metallic industries, and this is to be expected, as technical progress has been so much greater in the latter field. Possibly, however, those treating metallic ores may learn something of value from their neighbors in the non-metallic branch of mining. In the rough-stone industries rock breaking has become a science, and the low cost at which rock is placed at the crusher might be a revelation to some metal miners, and the methods employed might afford them food for thought. Though the non-metallic operator may learn something from the wet-treatment methods so common with the metals, may not those treating metallic ores also learn something about dry grinding and air separation that have made such rapid progress with materials such as limestone and silica? In the manufacture of portland cement, processes of fine grinding both of raw materials and clinker have reached a stage of perfection that demands recognition.

Experience, though a thorough teacher, is an expensive one, and in this age of rapid industrial development it pays not infrequently to utilize the ideas of others, rather than to follow the slow and weary pathway of individual experience worked out within the narrow confines of a single mine or mill.

An Excursion Into Rouyn—II

Three Proved Mines: Amulet, Waite-Montgomery, and Horne—Construction of the Railroad and Noranda's New Smelter—The Timmins Luck

By Arthur Barrette Parsons
Assistant Editor

Note: In the first part of this article, published last week, was described the journey from Kirkland Lake to Montbray Township and thence eastward, by way of the Nipissing, Coniagas, Tonopah, Alderson-McKay, and Consolidated Mining & Smelting properties. A map of the route taken by the author appeared on page 684.

FROM THE MAIN CAMP of the Consolidated Mining & Smelting Co., in Duprat Township, to that of the Amulet Mines Co., in Dufresnoy, is a walk of about one and one-half miles. As in the case of the Alderson-McKay, the No. 3 "showing" at the Amulet overshadows in importance the first two that were discovered. This orebody is actually blocked out and sampled by means of vertical diamond-drill holes, and the ore reserve is carefully calculated. It is a horizontal-lying lens roughly 550 by 100 ft. in horizontal dimensions and 30 ft. thick, with a comparatively thin overburden. Open-cut mining, possibly with draglines, presumably will be the method of mining this particular orebody. I am not at liberty to give actual assays and tonnages, but close to 200,000 tons of ore is assured, with a gross metal content of nearly $25 per ton at current prices for metals. The zinc, contrary to the general belief, is more valuable than the copper. Precious metals are worth about $3 per ton.

AMULET A ZINC MINE

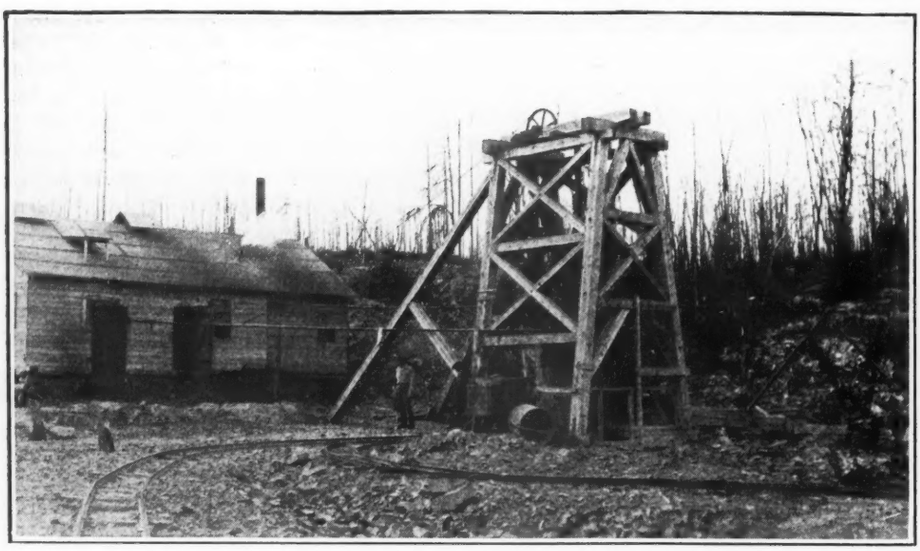
For the treatment of this ore a concentrator is planned, to have an initial capacity of between 100 and 200 tons per day. Selective flotation will be the treatment, the General Engineering Co., of Salt Lake City, Utah, now being engaged on tests preliminary to the designing of a plant. A zinc concentrate will be made and also one containing the copper and some iron. It may be profitable to drop the bulk of the iron in the tailing, depending upon the proportion of the precious-metal content that will follow the pyrite.

Distinct from the exploitation of this proven orebody is the sinking of a new shaft on No. 2 showing. The shaft in mid-September had reached a depth of 168 ft., and drifts were being driven on a fracture plane with the hope of finding good ore in the neighborhood of the contact between the two flows—rhyolite and andesite. An unexpected plum of sphalerite ore encountered in the shaft suggested the possibility of finding other similar and larger orebodies. The site for the mill is only about two miles from the line of the new railroad from O'Brien to Rouyn, so that a comparatively small investment will be required to construct the necessary spur. The present program provides for the early erection of the concentrator to be completed about the time the smelter at the Horne is ready to receive copper-iron-gold concentrates.

NOAH TIMMINS' BARGAIN

Carl Erickson, another representative of the Michigan College of Mines, is general manager for the Amulet. He is one of the few men who have their wives in the country with them, this possibly being explained by the circumstance that Mrs. Erickson has been Mrs. Erickson only a few months. Noah A. Timmins is a large shareholder in the company, presumably holding a controlling interest. In any event, A. F. Brigham, general manager for the Hollinger, is consulting engineer and had general supervision over operations.

About one and one-half miles north of the Amulet Camp is the Waite-Montgomery. Tom Montgomery

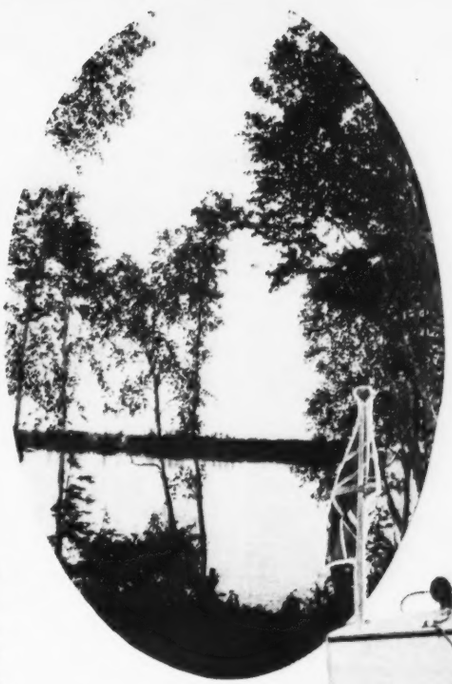


Shafthouse and headframe at the Amulet. This work is distinct from operations on the proved orebody

Carl Erickson faces the camera in digging clothes

Photographs Taken in the Rouyn Copper-Gold Area

Above—Charlie Colcross, left, and Alphonse Paré, general manager, outside the Waite-Montgomery office. In the oval is a glimpse of Osisko Lake, on the shore of which the Horne mine is situated



Above—The Waite-Montgomery camp buildings, among the best in the area outside of the town of Rouyn. Below—Motor boat that carries passengers down the Ottawa River to Angliers

National Bank of Canada

St. Bede's C. of E. Church

Two of Rouyn City's prominent institutional edifices

made the original discovery about two years ago. J. H. C. Waite, one of the most energetic and successful mining engineers in the region, financed Montgomery in the early days and got together a group of 47 claims, including 10 in the original group and 37 under option. Later Mr. Timmins acquired all but a small syndicate interest, and the enterprise now is virtually his personal operation. It is generally understood that the price was only $300,000. A small cash payment was made, with the other payments spread over several years. As it has turned out, he got a bargain. Alphonse Paré, on whose advice Mr. Timmins purchased the original Hollinger group in the Porcupine gold district, and who was the first superintendent of the Hollinger, took charge in January, 1925, and under his direction an extensive diamond-drill campaign was carried out.

The only surface exposure is at the discovery point, where two main trenches cut each other at right angles: the north-south is 100 ft. long and the east-west, 70 ft. long. The ore is a massive mixture of chalcopyrite, pyrite, and blende, with a little pyrrhotite and some granular quartz. Numerous assays from these trenches

On the steps of Rouyn's leading restaurant

Left to right, K. V. Heisey, K. A. McPhadyen, manager of Area Mines, and John Drybrough, geologist for the Victoria Syndicate

averaged: gold, $0.49; silver, 2.91 ounces; copper, 16.57 per cent; and zinc, 4.29 per cent, according to the report of A. O. Dufresne, provincial mining engineer for Quebec.

Mr. Paré, a graduate of McGill University, regretted his inability to disclose to me any of the results of the diamond-drill operations, because of the policy of those in control. For this he made up in a measure by entertaining me with music from the Hotel Astor, New York, via an excellent seven-tube radio set, and several rubbers of bridge during the evening.

Gossip places the ore reserves at something like 400,000 tons, with a gross value at current metal quotations of $10,000,000. Even if this figure for gross value were discounted 50 per cent, a good mine would still be assured. This much is certain: the railroad company is building a four-mile spur from the O'Brien-Rouyn branch to the Waite-Montgomery, and that in itself is the best evidence that a large ore deposit has been proved. Moreover, numerous additions are being made to the camp, which already comprises about fifteen well-built log cabins and a number of larger log structures that deserve a more elaborate designation than cabin.

Probable Extension of the Railway

Incidentally, Cyril T. Young, superintendent of development for the Canadian National Railways, crossed my path on a journey looking into the potentialities of the Consolidated M. & S., Alderson-McKay, Tonopah, and other properties with the idea in view of extending the Waite-Montgomery spur southward when and if development warrants. The topography is such that the Amulet must be served by a separate branch from the main Rouyn line.

The next morning Charles Colcross, accountant for Mr. Paré, piloted me by trail and canoe to Duprat Creek, down the creek to Default Lake, across a two-mile portage to Osisko Lake, and thence to the town of Rouyn, which lies on the south shore of Lake Osisko across from the Horne property.

On the portage we passed the Richardson property, where Messrs. Waite and Connell are having an electric survey made by the Lundberg method on a tract where dip-needle work has given encouraging indications. A section 1,500 ft. square is converted into a magnetic field by surrounding it with a single wire carrying a high-frequency, alternating electric current. Readings are taken at 150-ft. intervals on lines spaced 150 ft. apart, forming a checkerboard. The variation in readings depends on the greater conductivity of sulphide deposits compared with gangue rock as indicated by the intensity of the current detected by ear phones. The Lundberg engineers now charge $150 per day for their services, but data are being accumulated whereby a contract price per acre can be set. This will vary, of course, with the openness of the bush and other local factors.

H. C. Cooke Reads Good Literature

Likewise on this portage we met Mr. Waite, and an individual whose outward habiliments were almost disreputable, but who, it seemed incongruously, carried copies of *Harper's Magazine* and the *Atlantic Monthly* under his arm. I had the honor of being introduced to Dr. H. C. Cooke, dominion geologist, who is regarded as *the* authority on regional geology in the north country.

Now, to review the story of the Horne mine, and its almost bewilderingly rapid development. Ed Horne staked the original claims in the fall of 1922 for the Lake Tremoy Syndicate, which had grubstaked him. Tremoy is another name for Lake Osisko, on the shores of which the mine is situated. Ed is one prospector who made a good profit out of his find.

I am told on good authority that the members of the syndicate, in addition to $330,000 in cash, were given an interest equivalent to 125,000 shares of the present Noranda Mines stock. These are now selling at about $19 per share. Horne, with his fellow prospector Miller, had originally a 20 per cent interest in the syndicate. How much of Noranda he still owns, or what he got for such shares as he sold, I do not know, but he is said to be pretty well satisfied with the world today.

In 1923 S. C. Thomson and H. W. Chadbourne, who were working other claims in the vicinity, optioned the Horne group on behalf of the Thomson-Chadbourne syndicate. To them goes the credit for successfully developing the mine and financing the enterprise. They induced various strong New York interests to participate financially in the project, and they arranged to acquire sundry adjoining properties. Mr. Timmins acquired holdings in the enterprise at about this time, partly in exchange for certain properties and options that he held in the vicinity. Noranda Mines, Ltd., was formed to take over the option, the original capitalization being 5,000 shares at $100 each.

Airplane view of Noranda's Horne mine

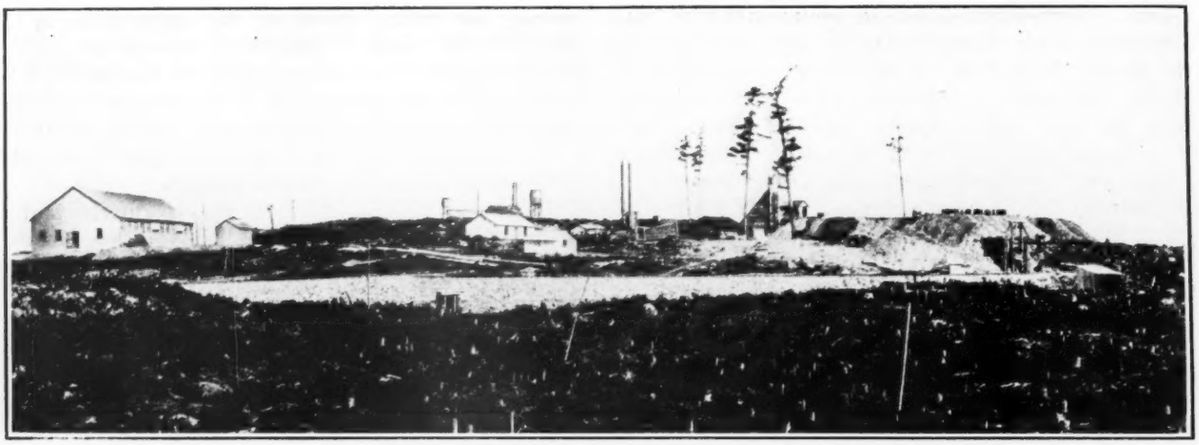
The clearing covers more than 400 acres. On the lake shore are the camp buildings. Behind are the prospect shafts and the small dumps. The smelter site is at the left of the picture, the new townsite just beyond the range of the photograph.

Rapid Development at the Horne

Trenching showed nothing of particular moment, and diamond drilling was undertaken. The first hole was not encouraging, but the second cut the present "A" orebody, and from that time on the mine grew with astonishing rapidity. Two prospect shafts were sunk (No. 1 to 300 ft. and No. 2 to 160 ft.) and diamond drilling was continued energetically. By the middle of 1925 sufficient ore was developed to warrant the building of a railroad and a smelter. The capitalization was increased twice, and in November a year ago 2,000,000 shares of no par value were issued. At current market prices the share value of the enterprize is about $38,000,000. Last February a subsidiary called the Horne Copper Corporation, all of the capital stock being held by Noranda Mines, Ltd., was organized to facilitate financing the smelter construction and to conduct the enterprise. Noranda Mines is still engaged in prospecting various properties in the district.

In December, E. Hibbert, who formerly had been manager for the defunct British-America Nickel Co. at Sudbury, Ontario, took charge of operations as general manager for the Horne Copper Corporation. He brought with him as assistant general manager H. L. Roscoe, who had been mine superintendent at the British-America. Archer E. Wheeler, of New York, was retained as consulting metallurgical engineer to design and erect the smelter and work was started on as large a scale as practicable, considering that no railroad was yet available.

On the evening that I spent at the Horne, Mr. Wheeler and J. H. Gillis, who is to be in charge of construction at the new smelter, arrived from Haileybury by airplane. The alternative to flying is a sixteen-hour trip by motor car and boat; the plane requires less than an hour. Neither traveler showed or admitted any ill effects from his flight. With these gentlemen and Messrs. Hibbert and Roscoe, I had a very good dinner at



The Horne mine. Left, warehouse; center background, No. 2 shaft; right, No. 1 shaft and dump

the company mess. Mr. Hibbert is a bachelor, and Mr. Roscoe has not yet brought his family to Rouyn. He comes from the Michigan College of Mines.

Huge Clearing at the Mine

The first thing about the property that impresses one is the immense size of the clearing—some 400 or 500 acres. Although it covers a kind of peninsula in the lake, the possibility of fire has made it advisable to clear the forest far beyond the area required for the smelter and town sites. This can be seen clearly in the accompanying airplane photograph.

The present status of operations is a remarkable illustration of the dependence of any large industrial undertaking on the railroad. This is magnified in the present instance because of the fact that freight is expected to start arriving at the mine about Nov. 15. That is to say, they have been doing without things that might have been brought in by other means of transportation, except for the anticipation of the completion of the railroad.

In talking of his plans Mr. Hibbert is constantly remarking "as soon as the railroad is finished." In fact, he occasionally pokes a little fun at himself for this reiteration. He says that if all the things they talked of getting on the first train were actually put on it, half the freight cars in Quebec would be required.

Electric Current Available Soon

However, among the early arrivals will be the transformers that will step down the electric current, brought over the new transmission line from the Quinze Power Co.'s hydro-electric project on the Ottawa River; and two new mine compressors, each of 2,500-cu.ft. capacity. Heretofore only about 800 cu.ft. of air has been available, and mine development has been seriously restricted as a consequence. Raising the permanent three-compartment operating shaft has been completed from the 300 to the 100 level, and when power is available this shaft, No. 3, will be sunk to 600 ft. Coincidentally, lateral development will be speeded up both by diamond drilling and by drifting and crosscutting.

The smelter site looking toward the Noranda townsite, with the town of Rouyn in the distance

Another class of freight that will be rushed is portland cement and structural steel for the smelter. Last winter 350 tons of cement was brought in over the snow at a cost of $60 per ton—winter hauling is practicable over roads that are scarcely passable in the summer—and a fair start on pouring the smelter foundations has been made. It is expected to be able to keep this work a few laps ahead of steel erection.

The grading for the smelter and for the various intraplant standard railway lines involved a great deal of hard-rock excavation, but that is practically completed. Incidentally, I noticed more or less copper in some of these cuts, and Mr. Hibbert remarked that on more than one occasion he was a little disconcerted for fear he hadn't gone far enough from the mine to build the smelter.

The plant will be comprised of eight Wedge roasters, two reverberatory furnaces, and two converters, to have a capacity of 1,000 tons of ore per day. In addition, of course, the necessary crushing and sampling units, power plant, and mechanical shops must be built. Space has been left in the layout of the plant for the erection of a concentrator—probably flotation—but for the time being the direct smelting ore is the center of interest.

Model Industrial Town

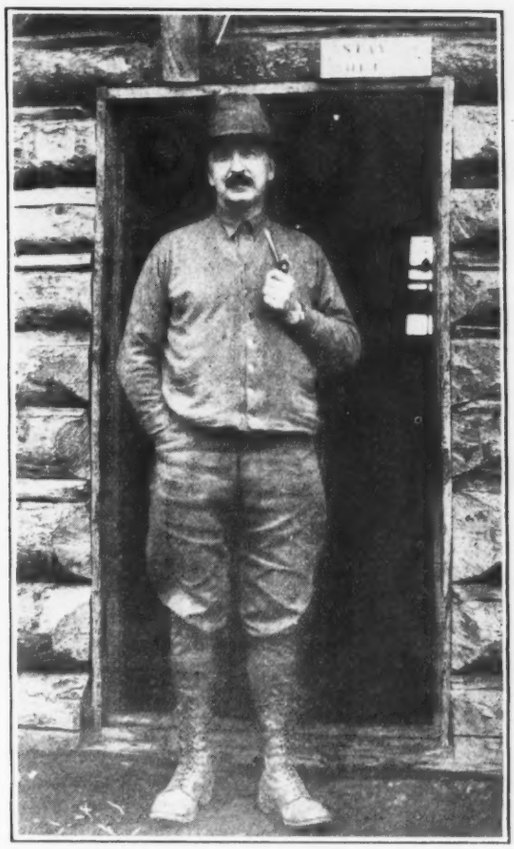
A model industrial town is being provided for the housing of employees. Roads have been subsurfaced with rock, water works and sewers are being put in, and the company is erecting and will erect a large number of dwellings and semi-public buildings. Lots will be sold to individuals under suitable restrictions. A rather handsome staff and guest house on the lake shore was nearing completion when I was there. Mr. Hibbert will soon move into it from the four-room log cabin that has been his headquarters for a year.

Of course, the heart of the whole enterprise is the mine—the orebodies. The most prominent geological feature is a 90-ft. dike of "later" diabase that strikes north-south and cuts with little or no deviation through the ore-bearing area. The orebodies so far developed are nine in number, five of which are particularly important so far as present development shows. They may be described as elliptical lenses or plums lying with the longer axes approximately vertical. The sections on a horizontal plane range up to 100 ft. in width and from 100 to as much as 450 ft. in length. The "A-D" orebody is 450 ft. long on the third level.

The country rocks are flows of rhyolite, andesite, diabase, and syenite porphyry, with intrusive dikes of the two rocks last named, all badly twisted, folded, and faulted. The orebodies consist of replacements of massive chalcopyrite and pyrrhotite mixed with some pyrite and containing little or no sphalerite. The "later" diabase dike divides the mass, and may represent a shear zone. Some evidence points to the possibility that the copper entered after the intrusion of this dike, according to Mr. Roscoe; but the pyrrhotite apparently was cut by the dike, and the same thing may be true of the copper mineral. The gold is probably free or in telluride form and is associated with the chalcopyrite and pyrite, but not with the pyrrhotite.

High-Grade Ore

The most recent published estimate of ore reserves is as of Jan. 1, 1926. It shows 944,525 tons with an average gold content of $5.54 and copper content of 6.7 per cent. Calculating copper at 14c. per pound, this would give a gross value of $24.30 per ton, or $22,951,957. However, an interim report, issued late in September, 1926, details the development of various large new blocks, including the new "E" orebody, which average up to $64.72 per ton. It then says: "It is obvious that the finding of new high-grade orebodies will increase the grade of ore as estimated in our report for the year ending Dec. 31, 1925, but an estimate of the increased tonnage must await further development. It is hoped that by the first of the year development will have carried far enough to give sufficient new sections upon which to base a recalculation of ore. For the present we do not feel justified in making any more definite statement than that the tonnage of ore indicated in the last report has been considerably increased and the grade materially increased. The confidence that the mine has a good future in depth, expressed in our last report, is strengthened by the third-level development."



E. Hibbert, general manager of the Horne, at the door of No. 1 compressor house

Smelter to Be Finished in Fall of 1927

My understanding is that the earlier estimate took in very little, if any, ore below the 200 level. In view of the work on the 100 and 200 levels, that was pointed out to me as being new, and of what I saw on the 300 level, I feel safe in predicting that the next report will show a gross value at least double that of the last and probably more.

One thing may well be mentioned: The ore is rich; therefore the per-pound cost of producing copper after crediting gold will be extremely low. As a consequence excellent earnings will be possible without putting a large tonnage of copper on the market. For example, an annual net profit of $7,200,000 is easily conceivable

without producing more than 60,000,000 lb. of copper per year. This is assuming the treatment of 30,000 tons of ore per month, having a gross metal content of $29, and costs and metallurgical losses of $9 per ton. The figures are purely hypothetical, of course. The smelter is scheduled to be in operation in the fall of 1927, and, unless all the breaks go against him, a man as competent and resourceful as Mr. Hibbert ought to keep close to schedule. Presumably then, income and earnings should begin to accrue within a year from the present time.

"Row, Anne!" "Rue-on," and "Ruin"

One point that might well have been mentioned earlier in this article is the pronunciation of the word Rouyn—a question on which unanimity is conspicuously absent. Versions vary from directing a young lady to use her oars, "Row, Anne," to plain "ruin" to rhyme with bruin. Several, whose authority ought to be good, agree on "Rue-on" (to continue to be sorry), with the accent on the last syllable. If one uses this form he will be in accord with the *intelligentsia.* The origin of the word appears to be Indian, though some consider it French. Incidentally the second name in Alderson-McKay is pronounced McKi, with the "i" long, by those who may be classed as early settlers.

During the progress of my journey eastward from Montbray I heard various tales of lurid goings-on last winter and spring in Rouyn. "Worse" than any of the old western mining camps, I was told. Although I did see some manifestations of bootlegging activities (that part of Quebec is supposed to be dry), Rouyn appeared to have outgrown or at least suppressed its "wildness." Unmistakable signs of youngness there were; but also of growth and prosperity. Except for goods that sell normally for a low per-pound price, and on which freight accordingly is an important element of cost, general merchandise is not expensive. Clothes, for instance, are reasonably priced. A fair meal can be had for 60c. Wages for surface workers are only about $4.50 per day at Rouyn, compared with $3.25 and $3.50 with board and lodging in the outlying prospecting camps in the area. Rooms in the town are rather scarce and expensive, and accordingly the Horne company has rushed to completion two large buildings where their men can obtain accommodations at more reasonable prices.

Other Meritorious Prospects

It should be explained that I did not by any means see all of the meritorious prospects; and the fact that no mention is made of the work of twenty other companies and syndicates does not mean that their operations are not as important or more important, perhaps, than some that I visited and therefore have described. Naturally, the ground adjoining the Horne holdings is of interest; propinquity to a big mine in itself is an asset. A large area lying mostly under the lake, held by the strong Osisko Lake Syndicate, is to be drilled extensively as soon as the ice forms this winter. Adjoining this are the Farrell-Rouyn property and the Murray group, said to have been optioned recently by the United Verde Extension interests of Arizona.

Usually the development of a few good mines is attended with the floating of a flock of stock companies, that base selling propaganda on proximity—close or not so close—of their holdings to the successful properties. This Rouyn area is no exception. Some of the stocks in which trading is active have a reasonable speculative value. As to others, the backers handling them probably would be more astonished than anyone else if ore were found.

With the exception of a small area in the northwest part of the Montbray, virtually all of the ground in the six townships in the territory under discussion is staked. In addition, large portions of the adjoining townships, particularly Hebecourt, Clericy, and Joannes, are covered with claims. The mining laws of Quebec provide for the performance of twenty-five days' work for each claim the first year, and fifty days' work the second. There is also an annual tax of $20 on each claim, the purpose being to discourage the holding of claims for speculative purposes. A payment of $5 per acre is necessary to obtain a "concession," comparable in a measure with a patent in the United States, and even this grant, I understand, does not prevent the government from recapturing the claims if certain annual expenditures are not made in connection with them. The government wants the mineral resources of the province developed, and the laws are designed to effect this object.

In Rouyn I asked a number of engineers why Mr. Timmins happened to be interested more or less heavily in all of the companies that to date had actually found copper in quantity sufficient to make a mine. A composite answer is something like this: Mr. Timmins made his immense fortune in Canadian mines, first at the La Rose, in Cobalt; then at the Hollinger, in Porcupine. He wants to see the mining industry of Canada expand and thrive. He knows that money is necessary to develop prospects and he can afford to risk his money. Accordingly, it is not an exceedingly difficult matter to get him to finance a likely looking prospect. Incidentally, he has put up money for a good many options that did not pan out, but of those little is heard, naturally.

Cash Payments Mean Much

Here is, however, a further interesting angle to this situation: The average owner of a prospect would give Mr. Timmins preference even if some other company was prepared to make a slightly better offer. In the first place, he is usually willing to gamble with a moderate cash payment at the start, which some of the others are disinclined to do. Second, the owner feels that Mr. Timmins will give the property a very thorough test before he will abandon it. And third, the prospector is just superstitious enough to put faith in the Timmins luck. It is customary for the owner to retain a small interest in his property; and as one man said "They all like to string along with Timmins."

My last night at Rouyn I slept at the Victoria Syndicate "shack" at the invitation of Mr. Heise, who had returned from Montbray Township, and John Drybrough, another of the Victoria geologists. The following day I made the 90-mile motor boat trip to Angliers, and from there drove by automobile to Haileybury. There I found awaiting me the baggage that I had sent on by express from Kirkland Lake, and of which, after seven days in the bush, I was in dire need. My excursion to Rouyn was at an end.

In conclusion I should like to pay a tribute to the men from McGill, Queens, and Toronto universities and from the Michigan College of Mines. It is rather remarkable, but true, that without exception the college men I met came from one of these institutions. As trail-blazing geologists, scientific prospectors, or "doodle-bugging" engineers—whatever one wants to call them—they are playing the leading part in developing this remarkable mineral region.

The Kentucky-Illinois Ore-Magmatic District—II

By J. E. Spurr

AT THIS stage of the discussion it will be well to consider the main occurrence of barite in the district, at what is called Cave-in-Rock, on the Illinois side of the Ohio River. Here deposits of barite and fluorite occur in sandy shales which lie at the base of the Rosiclare sandstone and the top of the fairly thick-bedded Ste. Genevieve limestone.

Narrow crosscutting nearly vertical fissure veins, on encountering shaly layers at the base of the sandstone, spread beneath and between them out into mushroom or blanket deposits along the stratification. These deposits are of considerable lateral extent and also several feet thick, a vertical extent quite disproportionate to the dimensions of the narrow vertical fissures, only a few inches or less wide, which seem to have fed in the solutions from below. This is the only ore deposit of this type in the Kentucky-Illinois district, the rest being simple fissure veins; so that it is of particular interest.

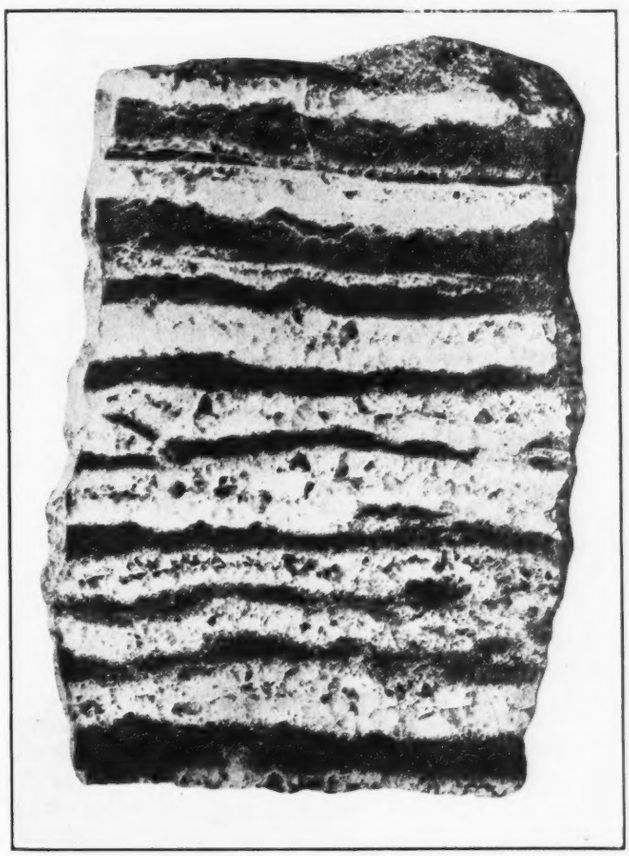


Fig. 4—Photograph of specimen from mine at Cave-in-Rock, showing alternation of crystalline fluorspar bands (light) with impure limestone layers (dark). Fluorite bands are ½ to ¾ inches thick. The limestone is partly replaced by fluorite. After H. F. Bain, Bull. 255, U. S. Geological Survey, Pl. V.

There were three principal ore horizons in the workings which our party visited, the uppermost 50 ft. above the lowest, and the intermediate one about midway between. The uppermost ore blanket lies under a definite shale layer 10 ft. or so thick, which is at the base of a thick sandstone layer. The vein material is mainly fluorite, with very little calcite; but there seems to be some evidence of replacement of calcite by fluorite. The deposit is usually flat banded, dense fluorite layers which are obviously due to replacement of limy shales alternating

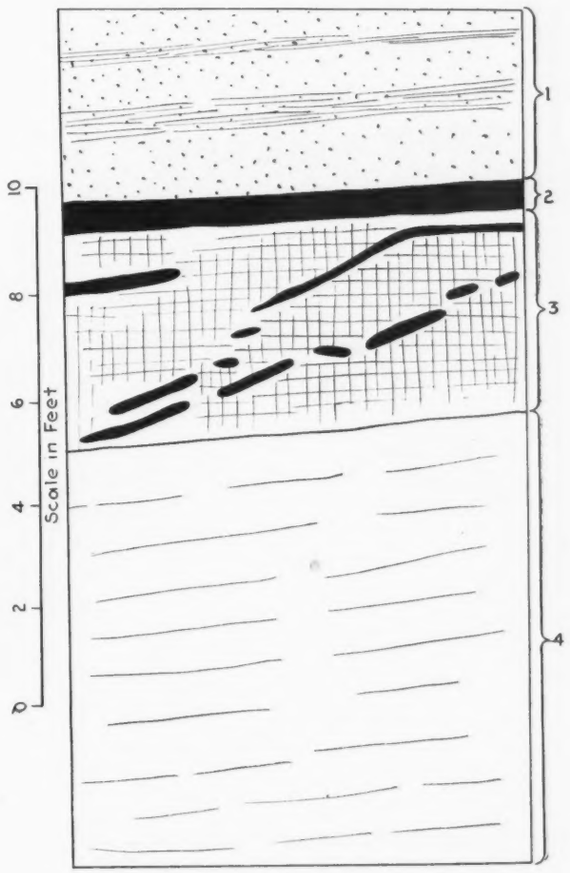


Fig. 5—Cave-in-Rock mine, Illinois fluorspar district

Vertical sketch section at one point across uppermost fluorspar horizon. 1, sandstone with shaly layers (Rosiclare sandstone); 2, dense green shale (base of Rosiclare); 3, coarsely crystalline fluorite with slabs and fragments of green shale from roof; 4, thick bedded limestone (Ste. Genevieve limestone).—By J. E. Spurr.

with coarsely crystalline fluorite which appears to have crystallized from solution (Fig. 4). Evidence of the latter conclusion of crystallization from a standing solution is shown in fragments and slabs of the shale roof of such horizontal fissure veins, which fragments are inclosed in and supported by the crystalline fluorite, showing that they fell into the fluorite solution when the latter was without replacing power and was thick enough to support such foreign inclusions (Fig. 5). Such shale fragments in coarsely crystalline fluorite, closely examined, have sharp straight boundaries and certainly have not been even slightly replaced; and that they are characteristically entirely isolated and unsupported in the fluorite was demonstrated by prying out some of them from the inclosing fluorite. The earlier formation of fluorite from calcite, then, is seen to be the result of chemical reaction.

Part I appeared in last week's issue.

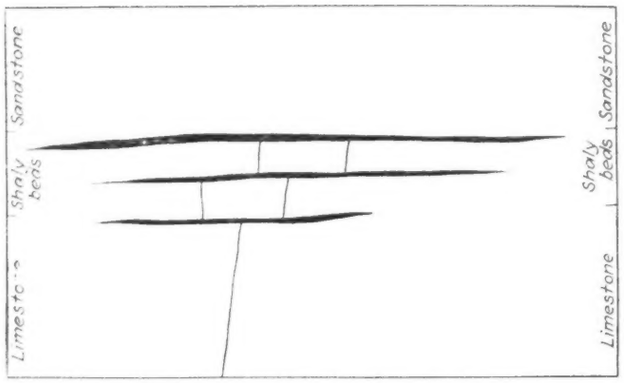


Fig. 6—Diagrammatic representation of type of ore deposit at Cave-in-Rock, Illinois

Concentrated ore solutions (ore magmas) ascending through very narrow fissures under pressure, spread out below and in blockading shaly beds, the pressure lifting the overlying rock. When considerable supplies of ore magma have thus accumulated in these reservoirs, crystallization takes place, either by replacement of the country rock, or by crystallization in the opened horizontal fissures, or both. At Cave-in-Rock both methods of crystallization have taken place, fissure-filling predominating. The mechanics are similar to those of the feeding of a sill of igneous rock by narrow dikelets.

In the margin of the uppermost fluorite bedded vein, where the fluorite terminates, the thickness of shale is seen to be slight. The indications are that the original upward fluid magmatic injection, ascending through small fissures under pressure, actually lifted up and separated the layers of the blockading shale bed, creating horizontal fissure veins interbanded with the shale layers, which fissure veins sustained themselves against the overlying weight until crystallization (Fig. 6).

The lowest of the three bedded deposits at this point is mainly barite, although barite was not observed in the two immediately overlying fluorite beds. This barite bed is on the underside of a definite shaly sandstone layer. The barite incloses fragments of sandstone, and there is no evidence of replacement; evidently the barite

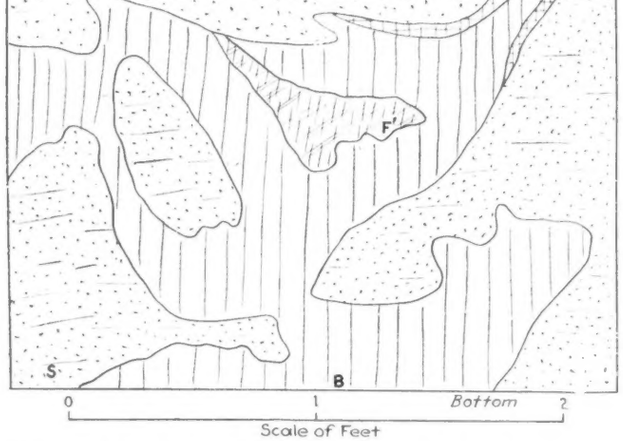


Fig. 7—Cave-in-Rock, Illinois, Cleveland mine "200." Lowest tunnel. Sketch of face of horizontal bedded barite vein, by J. E. Spurr

Shows crystalline barite *(B)* intruding and inclosing sandstone *(S)*; also inclosing fluorite *(F')* which shows traces of having in part replaced shaly limestone. *F* represents fluorite probably later than the barite crystallization.

magma forced its way along the stratification as a horizontal veindike (Fig. 7). In the same barite veins is fluorite, mainly, apparently an earlier crystallization; but fluorite was also the last crystallization, occurring in the center of the flat fissure veins (Fig. 8). A little lead and copper sulphides (galena and chalcopyrite) occur lining vugs.

Summarizing, the occurrence shows the upward injection, under pressure, of these earthy gangues, following one another in quick succession, and each forming horizontal veindike injections: (1) calcite, (2) fluoric solutions or gases which replaced calcite and shaly limestone bands and later probably developed in part a liquid or colloidal fluorite; (3) barite solution, which penetrated and perhaps replaced, to some extent, fluorite.

The conception of a fluid barite solution, in view of the insolubility of barite in water, is not a familiar one; nevertheless, the evidence is here (and indeed in barite veins in general) that it was not only a solution

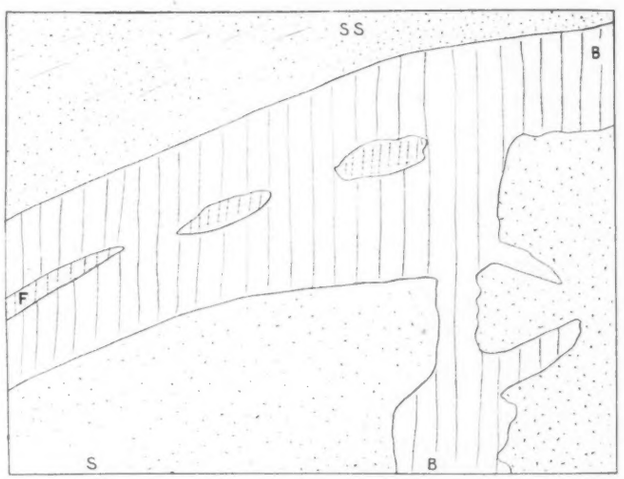


Fig. 8—Cave-in-Rock, Illinois, Cleveland mine "200." Lowest tunnel. Sketch of face of horizontal bedded vein, by J. E. Spurr

Shows crystalline barite *(B)* intruding sandstone and mushrooming out as horizontal fissure vein beneath shaly layer. Last crystallization, in center of barite, is fluorite *(F)*.

but a highly concentrated one, for there is no banding or other evidence of gradual deposition, but rather of a general contemporaneous crystallization from a standing solution, which supported included fragments of sandstone. Barite is absent in most of the calcite-fluorite veins of the district. Currier[35] writes that he has not seen it in solid vein material, but only in residual deposits. Even in such deposits it is not so abundant as, for example, in the barite deposits of Missouri, not far west of this Kentucky-Illinois region. Tangier Smith, on the other hand, found barite common in the Kentucky veins,[36] usually a later crystallization than fluorite.[37]

As in most ore deposits there are at Cave-in-Rock final vug linings in which most of the minerals of the veins are represented in a second generation, deposited apparently by their magmatic residues—calcite, fluorite, barite, and sparse sulphides. This Cave-in-Rock (Lead Hill) is of especial interest as showing that the barite is of the same origin as the fluorite—that is, magmatic.

[35] *Op. cit.*, p. 43.
[36] Professional Paper 36, U. S. Geological Survey, p. 135.
[37] *Op. cit.*, p. 145.

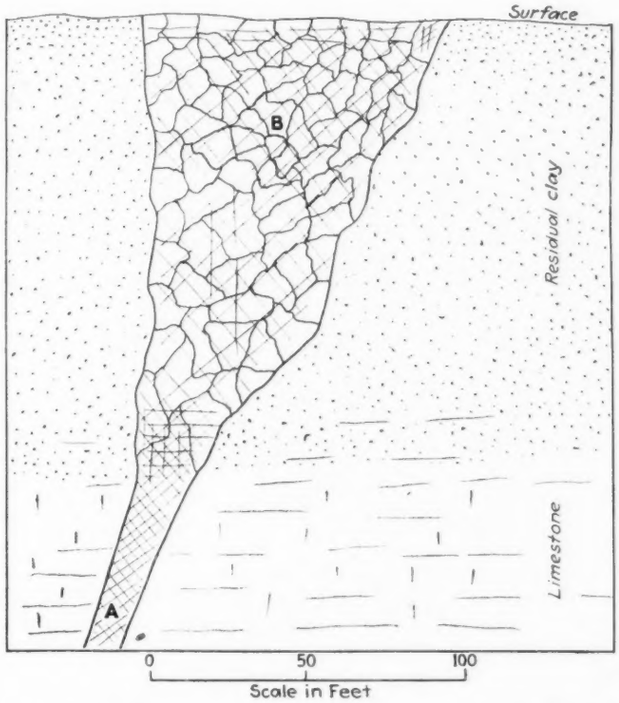


Fig. 9—Diagrammatic vertical cross-section showing accumulation of residual fluorspar at Haffau mine, Mexico, Ky.

A—Primary solid calcite-fluorite vein, low-grade as to fluorite: unaltered limestone walls. *B*—Broken residual fluorite, high grade, in clay walls residual from the disintegration of limestone.

Most of the barite of the general region is residual, in the clayey soils derived from the dissolution of the limestones; but by the evidence of the Cave-in-Rock deposit the ultimate magmatic origin of the barite in these residual deposits is demonstrated. Barite is a characteristic low-temperature barren-gangue phase of the ore sequence in other magmatic districts. One or two observations that I have made indicate that in the normal falling-temperature magmatic sequence, barite is usually earlier than calcite;[38] therefore the reversed sequence at Cave-in-Rock strengthens the indications above pointed out, of a rising temperature during the stages of mineral injection.

Taking the Kentucky-Illinois district as a whole, the fluorite, which is the chief mined ore, is now well known to be, as a rule, better at the surface and poorer in depth. This appears to be due to two causes, respectively primary and secondary. The secondary cause is evident and important. With disintegration and dissolution of the limestones which inclose the fluorite-bearing veins, the insoluble fluorite settles down and widens out, pushing back the softened clayey walls. The calcite of the mixed calcite-fluorite vein is also largely dissolved, raising the grade of the fluorite in the superficial portion. As an example, the Haffau mine, near Mexico, Kentucky, has residual fluorite ore as much as 150 ft. wide at the surface; at 100 ft. the ore is still residual and is 50 to 70 ft. wide; at 200 ft. the vein is primary, and is 6 to 20 ft. wide, and relatively low grade (Fig. 9). Consideration of these figures shows that a section of the vein, originally in limestone which overlay the present surface to a thickness of several hundred feet, has been concentrated by simple slumpage, while the limestone was gradually dissolved.

But much of the decrease of fluorite in depth cannot be ascribed to surface processes; it is, as is clear and universally agreed, of primary and therefore of magmatic origin. There has been a universal tendency for the fluorite shoots in the calcite veins to diminish in length and even in some cases practically to disappear, at depths which in different cases have varied from 25 ft. down to 725 ft., the present depth of fluorite in the Rosiclare mine. In this mine a fluorite shoot 5,000 ft. long at the surface has diminished to 2,000 ft. in length at 600 ft., so that the indications are that it will go to a depth of 1,000 ft. or so. (Fig. 10). As a rule the horizontal surface extent of fluorite shoots is far greater than the vertical extent. Yet the fluorine solutations evidently broke up through the calcite of the original veins, evidence of which I observed, for example, at the Daisy mine, near Rosiclare. The Daisy occupies a fault fissure of some 200 ft. vertical displacement (Figs. 12 and 13). The first filling (1) was of coarse crystalline calcite, inclosing angular fragments of country rock; (2) fluoric solutions or vapors penetrated the calcite intricately, producing fluorite; (3) there was renewed opening along the fissure, producing a gouge, but succeeded by no vein filling. Here at the south end of the mine (Fig. 11), the fluorspar shoots developed go up only to about the 300-ft. level, but further north on the vein the fluorspar shoots went to the surface. It would appear as if precipitation of the fluorite had been induced at a certain level or horizon; but that level cannot be the present surface, for the surface at the time of fluorite deposition was certainly far above the present. Bain states that the Daisy vein, near the surface, has a sandstone footwall and a shale hanging wall with a dip of 69 deg.[39] These are the formations which immediately overlie the (Ste. Genevieve) limestone. At the depth where I saw it (400 to 500 ft.) the footwall was limestone. The exact situation is shown in the cross-sections, Figs. 12 and 13, in which a refined sub-

[38] "The Ore Magmas," Vol. II. p. 864.

[39] Bain: *Op. cit.*, p. 47.

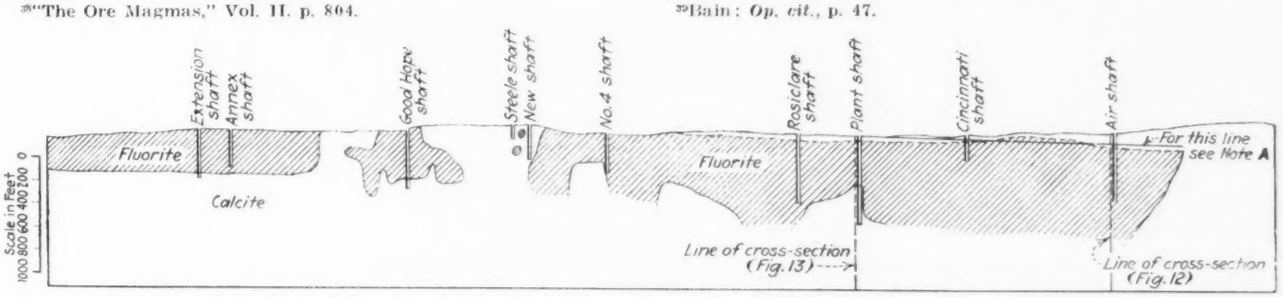


Fig. 10—Longitudinal vertical plan of Rosiclare-Fairview vein, Rosiclare, Ill., looking west, showing fluorite shoots in calcite veindike

Note A. Line shows top of limestone (Fredonia member of Ste. Genevieve) and bottom of Rosiclare sandstone, in footwall of vein, as transferred by J. E. Spurr from sections, Fig. 12 and Fig. 13

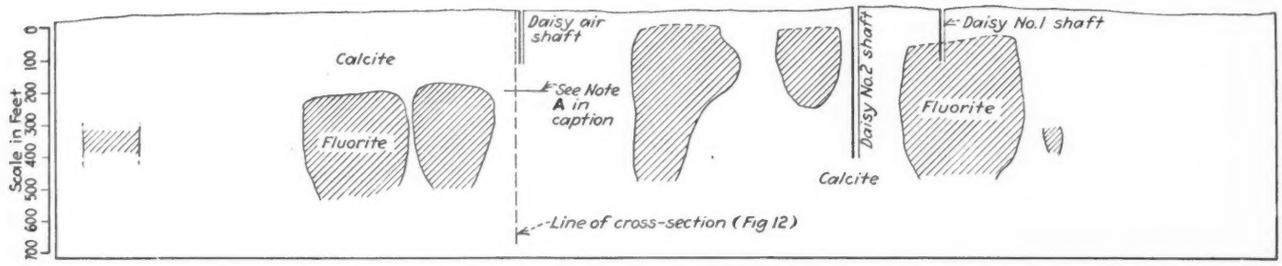


Fig. 11—Longitudinal vertical plan of Daisy Vein, Rosiclare, Ill., looking west, showing fluorite bodies in calcite veindike. By P. C. Hatmaker. Courtesy of Oglebay, Norton & Co.

Note A. Line shows top of limestone (Fredonia member of Ste. Genevieve) and bottom of Rosiclare sandstone, in footwall of vein as transferred by J. E. Spurr from section, Fig. 12

division of sedimentary formations has been used, the names of most of which have not been mentioned in this paper. The symbols, however, show the distinction between sandstone, shale, and limestone beds. The Fredonia limestone, the Rosiclare sandstone, and the O'Hara shale are subdivisions of the Ste. Genevieve formation. The situation at the south end of the Daisy mine, where the fluorspar shoots are topped at about the 300-ft. level (Fig. 11) is shown in cross-section in Fig. 12, where it is seen that at about this level the Rosiclare sandstone, with the overlying O'Hara shale, comes in on the footwall, corresponding with the same horizon in the hanging wall at a little below 500 ft. I have indicated this line in the longitudinal projection (Fig. 11) of the Daisy vein (Note A). Following up this idea, I have drawn a corresponding line (showing the same horizon) on the longitudinal projection of the Rosiclare-Fairview vein (Fig. 10) (Note A). I wish I had more data on this point, but what I have is certainly suggestive of a local control (partial at least) of the upper and longer line of the fluorite shoots by the top of the limestone and the bottom of the sandstone and shale on the higher side of a fault, from which inverted base the shoots tend to taper downward in limestone in one or both walls.

Weller has shown that at the time of igneous intrusion the surface was as much as 2,500 ft. higher than it now is. Post-mineral faults with as much as 1,500 ft. vertical displacement have not only been entirely subdued as surface features by subsequent erosion, but under favorable circumstances reversed erosion fault scarps have developed. Therefore the present surface deposits now exploited represent a depth of 2,000 ft. or more at the time of veindike injection. This also shows that the veindike injection took place soon after the peridotite intrusion.

Further evidence that the limited vertical extent of the fluorite shoots is due to the fluorite deposition having been induced especially at a favorable stratigraphic horizon or horizons is to be had at Cave-in-Rock, where, as stated above, this horizon is, as at Rosiclare, at the top of the massive St. Louis-Ste. Genevieve (Carboniferous) limestone, the shaly layers having acted as dams on the under sides of which the fluorspar had its greatest extent, diminishing downward. Above this sandstone are at intervals various sandstone and shale layers in the

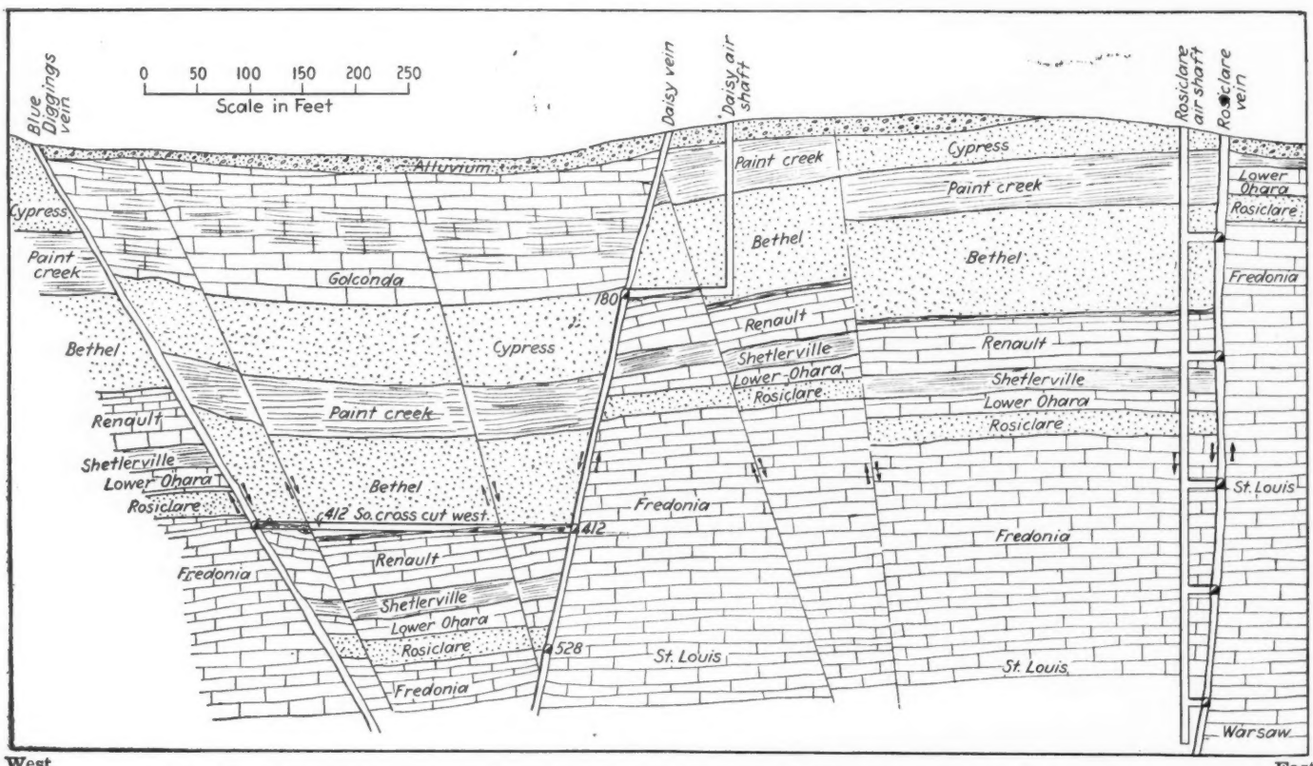


Fig. 12—Geological cross-section through Rosiclare and Daisy veins; by P. C. Hatmaker

immediately overlying Carboniferous formation; below, there is several hundred feet of fairly massive limestone, susceptible of fissuring, but not likely to dam and mushroom ascending solutions. Examination of the map of Bain[40] shows that most of the exploited fissure veins are grouped along this same general horizon, in the Hicks dome district in Illinois. Of the Kentucky-Illinois fluorspar district in general, Currier says:[41] "Veins of greatest economic value are found in the areas of faulting where at least one wall consists of the lower, thick, Ste. Genevieve-St. Louis limestone formation. Where both walls consist of sandstone, shale, or the thin Chester limestone, conditions were usually not so favorable for the deposition of economic orebodies."

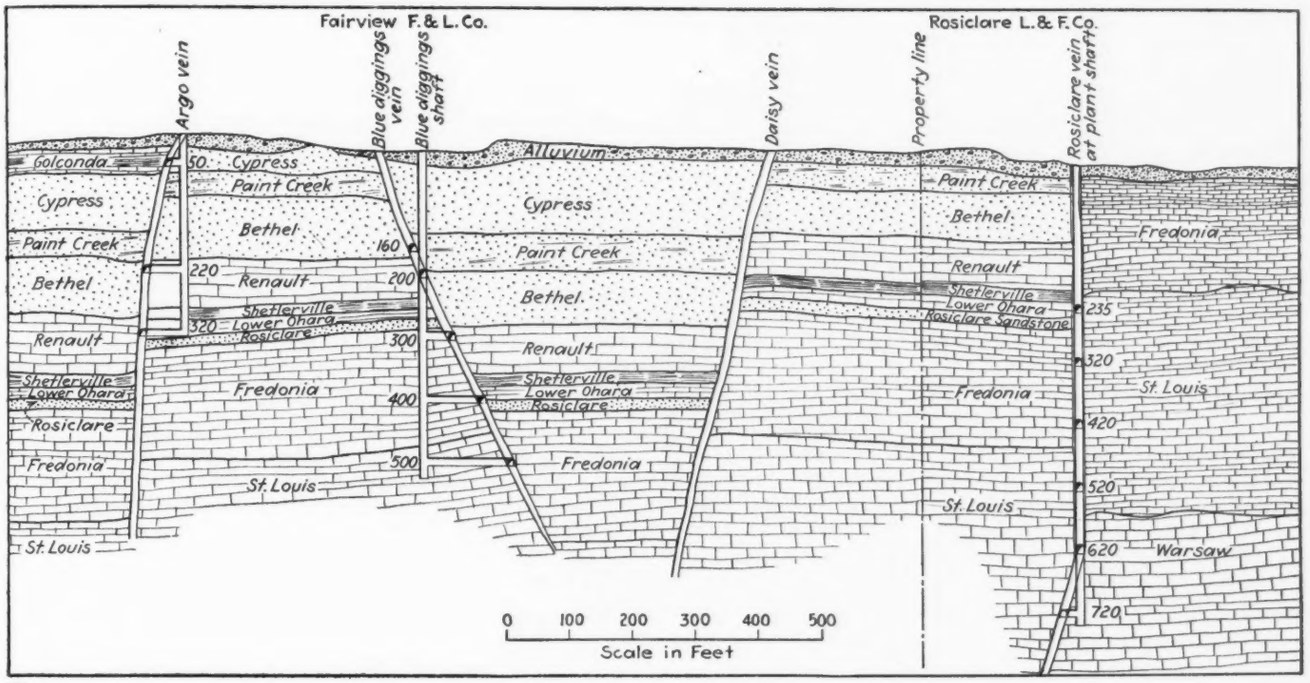


Fig. 13—Geological cross-section in the vicinity of the Rosiclare plant shaft. Courtesy of Oglebay, Norton & Co.

Taking this view of the localization of the fluorite at a horizon or horizons at the top of the massive Mississippian limestone, it would be interesting to follow these mineralized fissures to the base of these limestones and to the Devonian (Ohio) shale which underlies them, and explore the under side of this shale. The Ohio shale is only exposed in spots in this area, in the center of the Hicks dome in Illinois, and the underlying rocks are not exposed at all.

The vertical relation of galena and blende merits a note. Although they were precipitated simultaneously, according to the reports of the different geologists, Dr. Allen assures me that on the Rosiclare vein galena is distinctly massed on the upper levels, blende below. Near the surface galena made up about 2 per cent of the whole vein; but there was practically no galena, only blende, below 200 ft. The galena, he states, was intercrystallized with fluorite, and cannot be secondary. Such a relation of galena overlying blende might be ascribed to zoning according to temperature, by ascending ore solutions; but in this case the differences in vertical distances are so slight that this explanation will probably not hold. A third explanation would be that in a standing lead-zinc magmatic solution, a stratiform arrangement may take place whereby lead accumulates above (at the base of some barrier which also dammed and precipitated the fluorine solutions) and zinc below it; and that the stratifying force, whatever it is, is not temperature. This principle, indeed, finds illustration elsewhere, as I will point out in a later paper on the Joplin district in Missouri. It is not gravity, for lead sulphide is far heavier than zinc sulphide. In some other districts it appears that lead with respect to zinc tends not only up toward the top of the orebodies but laterally also out to the margin of the orebodies, so that its distribution corresponds with the effects of gaseous transfer.

A smaller and restricted fluorspar area (the Mercer County area) lies in Kentucky some miles east-northeast of the main district, and this Mercer County district is also characterized by localized faulting and hence is probably a magmatic district. And continuing east-northeast in a straight line to Elliott County, peridotite dikes and pipes outcrop (Fig. 1). The magmatic belt, characterized at intervals by faulting, by peridotitic pipes and dikes, and by deposits of fluorite, with barite, lead and zinc, traverses the whole of Kentucky.

In Illinois, directly north of the fluorspar region of Pope and Hardin counties, in Saline and Gallatin counties, peridotitic dikes of the same type as those in the fluorspar field have been found in the coal mines.[42] These are often wider, indeed, than those found further south. Due to the decomposition of these dikes, they are not recognized on the surface, which leads to the belief that their occurrence is wider than yet realized.

It should be emphasized that while the different stages of crystallization (1, calcite; 2, fluorite; 3, sulphides) of this magmatic injection are definite, yet they are

[40] Bull. 255, U. S. Geological Survey, 1905, Pl. III.

[41] "Fluorspar Deposits of Kentucky," Bulletin of the Kentucky Geological Survey, Vol. 13, p. 5.

[42] Bull. 19, Co-operative Mining Series, Illinois Geological Survey, 1919, pp. 33, 34, 35, *et. seq.*

overlapping and constitute in general three stages of crystallization of a single veindike injection. While fluorite replaces calcite within the veindike, its activity is confined to the veindike and to a slight extent to the immediately adjacent limestone wall—it does not form irregular or bedded replacement deposits in limestone. The apparent exception at Cave-in-Rock has already been explained as essentially a series of veindike sills, and in this sense they conform to the rule above pointed out. The same in general is true of the sulphides in the veins. We must deduce that the original column of veindike magma as injected contained in a mingled form the materials from which all of the above, and also barite, subsequently consolidated; and that the sequence calcite-fluorite-sulphides was the order of crystallization from this original vein magma. The initial calcite consolidation left fluid the fluoric and metallic residues at greater depth and higher temperatures in the same fissures, or in the reservoir whence the calcic magma had risen. With the fissuring of the calcite above by shrinkage on and during consolidation, and an assumed rise of temperature due to a renewed slight surgence or other slightly increased thermal activity of the basic magma below, the volatile fluoric solutions ascended and formed fluorite. It is entirely possible that some of the alteration of calcite to fluorite was magmatic; that is to say that it took place when the calcite was in a still fluid stage of semi-consolidation—whence a fluid fluorite stage developed, which filled small fissures in the veindike and so crystallized. With, possibly, a slight further temperature increment, the fluid-volatile sulphides ascended from the lower part or base of the fissure, and by replacement of the earlier veindike calcite and deposition in crevices formed the final crystallization stage. In general, elsewhere it is found that sulphide ores are deposited at a temperature above that of the carbonate veins;[43] although where carbonate and metal crystallize out under the same conditions and from the same solution, the carbonate characteristically crystallizes first, so that the assumed increase of temperature,[44] though probable, need have been only slight.

Another point which needs to be emphasized in this district and in other comparable ore districts is the existence and significance of vugs. Clearly they represent the final residue of the vein magma, trapped by progressive consolidation, which residue finally escaped and vanished. It was therefore volatile or mobile—that is to say, gaseous-aqueous. But the solid materials which it held in solution were first deposited as free-growing and beautiful crystals on the walls of the cavity in which the residue was trapped; and these materials constitute remainders of most of the veindike or other ore materials already consolidated, constituting what is usually called a second generation, together with rarer ore-magma elements which have not yet been precipitated, or have been so thinly precipitated that their concentration in these gaseous-aqueous residues produces noteworthy last-formed crystals. The vugs of the calcite-fluorite veindikes conform to a general rule. They are common, but not relatively abundant in point of space occupied, whereby it is concluded that the original vein magma did not contain much water and other volatile constituents—a conclusion also indicated by the clear intrusive nature of the veindikes and the confinement of the ores to the actually opened fissures even in limestone. The occurrence and order of crystallization of these vug minerals often obscure, in geological reports and descriptions, the relations and sequence of the great earlier consolidated masses. In the district under consideration all of the earlier-formed constituent minerals appear in this "second-generation" guise, lining the walls of vugs, generally as the finest crystals, and hence most striking and convincing to the mineral collector and to the geologist who draws his conclusions from mineral specimens and laboratory study. But the order of crystallization in vugs may be inverted from the general sequence. As illustrating the concentration of sparse constituents in the residue trapped in vugs, Dr. Allen writes that at Cave-in-Rock, "Iron-copper sulphides are found as incrustations on spar and calcite in vugs." In this deposit galena has the same occurrence (in vugs) as iron-copper sulphide.

This conception of the origin of vugs in veindikes I have already advanced in the case of the Camp Bird veindike in Colorado.[45] These ore-veindike vugs are closely analogous to the vugs in pegmatites, which appear to have the same origin, and in which rare minerals notably crystallize; so that the general physical nature of pegmatite and ore magmas is emphasized, as it is indeed by every other method of comparison."[46]

What was the nature of these volatile residues? If we knew this, and could add the elements or compounds therein contained to the now solid vein materials, we should have a closer knowledge of the nature of the ore magmas. The general assumption would be that the residual material is water; and that the solid materials were in aqueous solution—and usually we give little or no thought to the examination of this assumption. But consider, for example, the barite vein described above at Cave-in-Rock—the barite engulfed, surrounded, and probably in part replaced an earlier fluorite crystallization; but after the crystallization of the barite was complete, fluorite crystallized, filling the center of the vein. A single solution in this case held in solution barium sulphate and calcium fluoride, or the elements from which they were precipitated. All the evidence is that the solution was concentrated, with a minimum of solvent — there is no banding, but mass crystallization. This solvent could not have been water; both barium sulphate and calcium fluoride are relatively insoluble in water, with the result that both form important residual deposits in this region, resisting the age-long attacking waters which have dissolved away the limestone which inclosed the veins and also have dissolved the vein calcite. Water may conceivably have effected the precipitation of barite and fluorite in the veins, but not their solution—not their extraction out from other far more water-soluble elements and compounds (like iron) in the underlying magma. But we know that magmatic water is an important part of magmatic exhalations; hence the usual assumption that water has been the carrier of ore deposits. It may be that in the magmas, including the ore magmas, the elements of water—hydrogen and oxygen—though present, were not necessarily combined as water. Very likely, also, in the case under discussion, barium did not exist in solution as barium sulphate—that is, in the form in which it became insoluble and went out of solution. Similarly fluorite probably did not mainly exist in solution as calcium fluoride. We can only reason with any degree

[43] "The Ore Magmas," Vol. II, pp. 809-10.
[44] "The Ore Magmas," Vol. II, p. 810; see also p. 805.
[45] *Economic Geology*, March, 1925, p. 151; Vol. XX, No. 2.
[46] "Geology Applied to Mining," second edition, 1926, p. 159.

of safety as to the elements in this ore magma—Ba, Ca, Fl, C, O, S, and probably H (the last as evidenced by the hydrocarbons found frequently in the fluorite and calcite), with some Pb, Zn, etc. Also, there is the possibility or likelihood of the presence of the alkaline metals Na and K, since these are usually removed without trace, in aqueous solution. Altogether, the conditions permit the consideration of the theory recently advanced by Freeman,[47] that the ore magmas, including the metals and the earthy metals such as calcium and barium, have been extracted from the rock magma by alkaline sulphides; and that reactions at favorable temperatures with magmatic volatiles, such as water, carbon dioxide, and fluorine, or fluorides, produced insoluble compounds, a colloidal stage and ultimate crystallization. On this theory the residues trapped in vugs would be concentrated alkaline solutions in water, together with the excess of other volatiles.

Bearing upon this problem is an experiment made by Mr. Freeman, and recorded in a letter to me under date of March 24, 1926. Concerning the metals, copper, zinc, lead, and silver, he writes that with sodium sulphide, "they are soluble, as I have shown, at 500-600 deg. C., forming the eutectic double sulphides, but with water present they may be soluble and liquid at lower temperatures than this. I know that this is so with iron sulphide, which is slightly soluble in dilute aqueous sodium sulphide at 0 deg. C., and increasingly soluble with increase of temperature and decrease of water until the system Na_2S:FeS (dry) is obtained. The effect of pressure I have not investigated." The effect of water would appear, therefore, to decrease the solubility of the metal, while permitting some solubility at far lower temperatures.

Altogether, it must be confessed that we have as yet no adequate picture of the chemistry of an ore magma like, for example, that from which the veins of this Kentucky-Illinois district have been formed, except to reaffirm the conclusion at which I have arrived in the case of many ore magmas which I have previously considered—that the magma was relatively highly concentrated, with no more fluid solvents and residues than characterized the ordinary pegmatite magma; and that the fluid solvents were not primarily water, although water was probably present, and contributory, perhaps, both to the solution and to the later precipitation.

In "The Ore Magmas," I summarized the evidence as to water as follows: " . . . in view of the evidence of a very widely varying amount of water and other gases like fluorine, boron, etc., while metallic sulphide deposition remains constantly heavy, there is demonstrated the fact that water and these gases, the abundance of which has been long supposed to be the *sine qua non* of ore deposition, are really necessary, if at all, only in very small relative amounts."

J. V. Lewis, in a brilliant paper[48] calls attention to the universal presence of the hydrocarbon gas methane (CH_4) in magmas and magmatic exhalations and to the fact that volcanic gases also contain carbon monoxide and free hydrogen. He says: "Methane, which is universally present, is the logical source of the hydrogen and carbon. Hence both the free hydrogen and carbon monoxide, on the one hand, and portions of the magmatic water and carbon dioxide, on the other, may reasonably be attributed to the reaction of this hydrocarbon, and its derivatives, with oxidized materials encountered on the upward journey of the magma. . . . The fact remains, however, that, regardless of its distribution, there is a persistent deficiency of oxygen under the conditions of igneous intrusion, as shown by the generally observed fact that magmas and their emanations are themselves reducing in character. Thus, ferric oxide and hydroxide in iron-stained sediments and ash beds are found reduced, in zones of contact metamorphism, to magnetite and various ferrous minerals. . . . The frequent presence of methane among the surface emanations, even in the shattered and deeply oxidized volcanic belts, and its universal occurrence among the gases imprisoned in the deep-seated igneous rocks, point clearly to the hydrocarbons as a source of much of the magmatic hydrogen and carbon that appear at the surface as water and carbon dioxide.[49]"

The presence of hydrocarbons in the calcite-fluorite magma of the Kentucky-Illinois field is shown by the widespread hydrocarbon inclusions recorded in the fluorite and to a less extent in the calcite of the fissure veins (p. 698, Oct. 30 issue). That some of the inclusions were originally of gas at a greater temperature than at present, and that they cooled to a liquid after inclusion, is indicated by the presence of gas bubbles in some of the hydrocarbon inclusions,[50] a phenomenon like that of gas bubbles in similar inclusions in quartz veins, where, according to Dana, the liquid inclusions are "either water (pure, or a mineral solution) or some petroleum-like or other compound." Liquid and gaseous carbon dioxide and other gases also thus occur in quartz crystals in various localities.[51]

The heavier hydrocarbons, including petroleum and bitumens, may be formed from the gaseous hydrocarbons by the action of catalysts, of which nickel is one of the most powerful. Ramsay has found nickel in every petroleum examined.[52] Nickel is highly characteristic of basic magmas, such as underlie the Kentucky-Illinois magmatic district.

That the heavy hydrocarbons (in part reported as petroleum) in the fluorite of the Kentucky-Illinois district are very likely of magmatic origin is suggested by their association with the undoubtedly magmatic element fluorine, as well as in other occurrences of fluorite.[53] Not only does the fluorite usually, and the calcite more rarely, give out a bituminous odor when broken or heated, but much of the limestone of the district, when broken or heated, gives off a similar odor. This is ascribed by Ulrich and Smith[54] to organic matter, but in view of the above, even the hydrocarbons in the limestone may equally well, or indeed perhaps with a greater degree of probability, be ascribed to magmatic exhalations. This also applies to the small amounts of fluorine in the limestones of this region, which cannot reasonably be attributed to an organic source.[55] These highly volatile substances have diffused further into the wall rocks than any other recognizable magmatic constituents. Indeed, the observations that the odor is frequently much stronger in the fluorite than in

[47] *Engineering and Mining Journal-Press*, Vol. 120, No. 25, Sept. 19, 1925, p. 973.

[48] *Engineering and Mining Journal-Press*. Vol. 120, No. 4, July 25, 1925, p. 137.

[49] *Op. cit.*, p. 138.

[50] Ulrich and Smith: Professional Paper 36, U. S. Geological Survey, p. 127.

[51] Dana: "System of Mineralogy," p. 188.

[52] Cited by Lewis, *op. cit.*, p. 138.

[53] Cited by Ulrich and Smith, Professional Paper 36, U. S. Geological Survey, p. 125.

[54] *Op. cit.*, p. 128.

[55] Bain: U. S. Geological Survey, Bull. 255, p. 650.

the limestone[56] strengthens this possibility. "Sometimes the amount of contained hydrocarbons is so great as to make the fluorite somewhat brownish or blackish. This coloring matter appears to be concentrated along the cracks and between the grains of granular fluorite and gives a bituminous odor when heated. Rarely the cleavage surfaces of the fluorite have the appearance of being moistened with a film of oil, and at the Bonanza mine occasional pockets of oil are reported as occurring with the ore. Finally, small films of asphalt are sometimes, though not often, seen on the fluorite."[57]

A tentative working chemical hypothesis may perhaps be suggested: that the earthy metals, barium and calcium, together with the metals lead and zinc, ascended in a concentrated alkaline sulphide solution, together with alkaline fluorides and hydrocarbons (methane and heavier derivatives); that on being injected into an upper zone, say 2,000 ft. from the surface, and standing in the intruded and distended (widened) fissure, gradual oxidation produced water and carbon dioxide from part of the hydrocarbons, the combined effect of which, together with reduced pressure, was to render insoluble and to crystallize the barium and calcium as sulphate and carbonate respectively, and the other metals as sulphides. Possibly the encounter with exogenous water of shallow origin, at this horizon, contributed to the precipitation, playing possibly an important rôle. Thereafter the fluorides attacked the solid or colloidal calcite and partially altered it to fluorite.

This is confessedly a tentative hypothesis, which may be far from correct, but as a working hypothesis it may temporarily at least replace the older notion of water, magmatic or otherwise, as the chief extractor, solvent, and carrier for the vein materials—a belief which now seems wholly untenable and hence one which must be definitely discarded.

In Saline and Gallatin counties, Illinois, just north of the Illinois fluorspar-bearing counties (Pope and Hardin) numerous and frequently large dikes of peridotite rock[58] have been encountered in the coal mines; although in these northern counties there are no calcite-fluorite-barite-sulphide veins. Faults (normal), however, are abundant, so that this is part of the same magmatic province. The faulting is closely related to intrusion in these coal mines: "It is not improbable that intrusion was accompanied by faulting, and that there has also been later movement."[59] The coal is coked near the dikes, when the latter cut up through them, coking extending, for example, some 4 ft. on each side of a 2-ft. dike.[60] In places where there are faults and no dikes, there is a most interesting phenomenon, the coal being slightly coked on each side of the fault fissures "as though hot gases at some time after faulting had traversed the fault planes."[61] In some mines the coal has undergone much silicification for about 3 ft. from the dike contact, and outside the zone of silicification the coal has been coked.[62] In other cases "the contact between the dike and the coal is accompanied by calcite crystals"; and the coked coal on either side of the dike is cut by veins of calcite. Similar veins also traverse the dike, commonly lying parallel to the dip of the dike.[63] There was, therefore, first a driving off of volatile gases from the coal by the heat of the dike and apparently in part, at least, by the heat of gases given off from the dike, at a temperature which must have been at least 400 deg. C.[64] I have recorded in an earlier paper that the temperature of consolidation of basic dikes is probably around 400-500 deg. C.,[65] though the temperature of the fluid magma is, of course, hotter. After the consolidation of the dikes and the coking of the adjacent coal, solutions ascended and filled the shrinkage and other cracks with calcite—apparently quite analogous to the calcite injections in the fluorspar districts of the south. The silicification reported in some cases was doubtless also subsequent to the consolidation, and analogous to the quantitatively unimportant silicification of the wall rock of the veins in the Kentucky-Illinois fluorspar region. But in these coal fields there was no period of fluorspar or of metallic sulphide deposition, showing that these were not universal emanations from cooling magma, but special differentiates from the deep and underlying magma, gathered into local plutonic reservoirs and injected upward in highly localized districts.

[56] Ulrich and Smith, *Op. cit.*, p. 128.

[57] *Op. cit.*, pp. 128-129.

[58] In one case determined as olivine kersantite. G. H. Cady: Bull. 19, Co-operative Mining Series, Illinois Geological Survey, 1919.

[59] *Op. cit.*, p. 35.

[60] *Op. cit.*, p. 57.

[61] *Op. cit.*, p. 54.

[62] *Op. cit.*, p. 59.

[63] *Op. cit.*, p. 57.

[64] "The Ore Magmas," Vol. II, p. 657.

[65] Bull. Geological Society of America, Vol. 36, No. 3, 1925, pp. 563, *et. seq.*

Mechanism of the Pyrites Roasting Process

G. F. Hüttig and P. Lürmann (*Z. angew. Chem.*, 1926, 39, 759-765) state that by heating iron pyrites and ferric oxide separately in atmospheres containing mixtures of oxygen, sulphur dioxide, and sulphur trioxide at 700 deg. and analyzing the gaseous and solid products, it is shown that the reaction between pyrites and oxygen is reversible and that the final product in all cases is a homogeneous solid solution of oxide and sulphide; on cooling, these interact with the formation of ferrous sulphate and oxide, thus: $4Fe_2O_3 + FeS = FeSO_4 + 8FeO$. The composition of the solid solution is given by the equation $1/n = 13{\cdot}0 - 6{\cdot}66 \log (p_{SO_2}/p_{O_2})$, where $1/n$ is the Fe:S atomic ratio. These facts explain the presence of 3 to 6 per cent of residual sulphur in all samples of commercial burnt pyrites.

Disk vs. Roll Crushers

A new spring head to yield when non-crushable material, such as tramp iron, occurs in the feed, is a feature of the new Symons horizontal-shaft disk crushers, mentioned by Richards and Locke in the new volume of "The Mineral Industry" recently issued. Also, the vertical disk crusher has been improved by the use of babbitted bearings, the bushing of all wearing parts, and the making of the main frame of steel instead of cast iron.

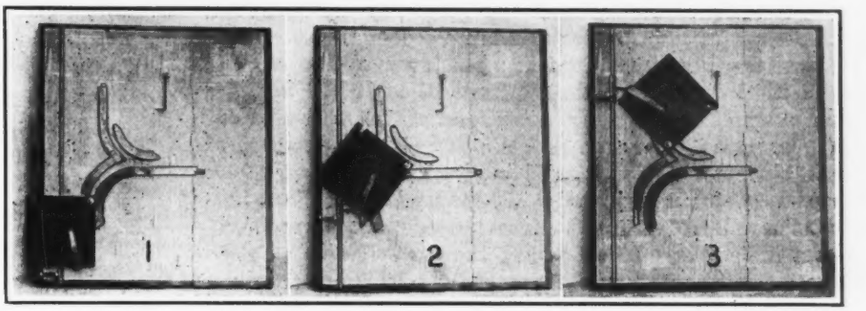
D. Cole has concluded that at the New Cornelia mill disk crushers operate at a cost at least 40 per cent less than rolls, and that the original cost of the roll equipment is double that of the disks. Another operator is quoted as saying that disk crushers give a more uniform product, are easier to run, and operate at less cost, though they are not so good in small mills and cannot handle moist ore that packs. However, in remodeling the Old Dominion plant, at Globe, Ariz., 60-in. rolls were installed in the last of the three steps of crushing.

Useful Operating Ideas

Working Model of a Skip Dump

By Walter S. Weeks,
Berkeley, Calif.

A TWO-DIMENSIONAL working model of a skip dump may be easily constructed on the working drawing and the plan here shown. The blueprint of the side elevation is glued to the board. The various guides are placed on the proper lines of the drawing. Figs. 1, 2, and 3 show the model with the skip in different positions.



Figs. 1, 2, and 3—Showing various positions of cage

The vertical guide is made of a brass rod of rectangular cross-section. The attachment of the shoe to this guide is shown in Fig. 4. All parts are of brass. The dumping guides are made of wood with a brass flange on the outside to hold the model of the skip against the board. A cross-section of the dumping guides and the skip wheel are shown in Fig. 5.

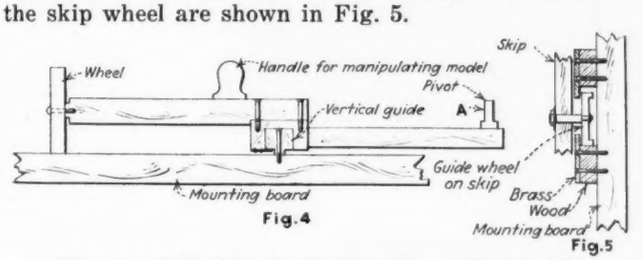


Fig. 4—Attachment of shoe to vertical guide
Fig. 5—Dumping guides and guide wheel

The spring shown on the side of the skip in the photographs aids in holding the skip against the board. One end of the spring is secured solidly to the center of the skip; the other end fits loosely over the pivot *A*, Fig. 4.

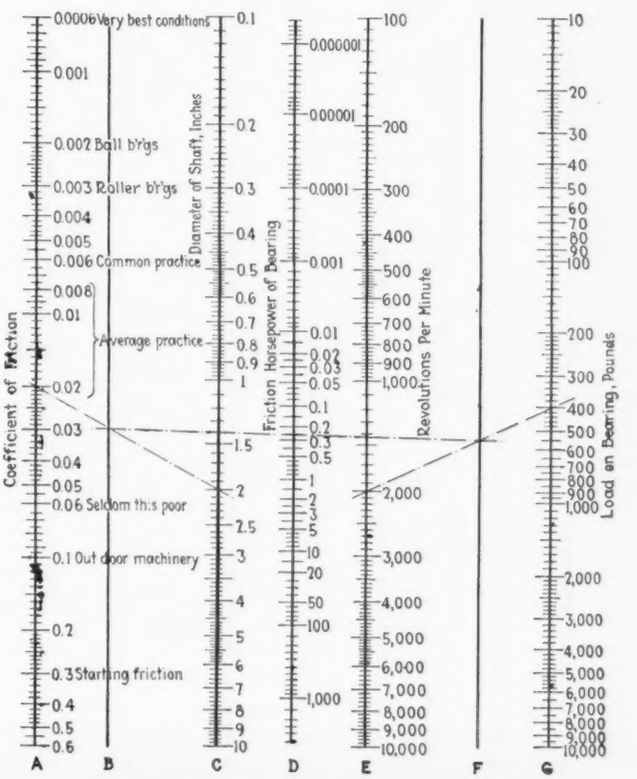
The skip is made of three-ply veneer wood to prevent warping, and to the same scale as the drawing. Such a model is useful in demonstrating the dumping of a skip or is a test model for studying the operation of a given design.

Ball, Roller and Plain Bearings

By W. F. Schaphorst
Newark, New Jersey

If the power is turned on frequently, even though not continuously, and if electric motors are used for driving, ball or roller bearings may be better than plain bearings because the starting friction of plain bearings is high. (See accompanying figure, Column A). On the other hand, the starting friction of roller and ball bearings is not much greater than the running friction. Hence smaller motors may frequently be used with ball and roller bearings. Where plain bearings can be kept in good condition at all times the cost of the frictional loss as compared with ball or roller bearings is often a small item and may as well be neglected. For example, the frictional cost of running the main bearings of an engine, generator, motor, turbine, pump, or similar large unit is ordinarily small as compared with the total power involved, whereas the difference in cost between ball bearings and plain bearings is high. Under such circumstances, therefore, plain bearings may be more economical, even though they are slightly less efficient.

On line shafting where lubrication may be comparatively difficult, the difference in friction may be large and hence the cost of power considerably less with ball or roller bearings—under such circumstances it is advisable to use low-friction type bearings. An important advantage of roller and ball bearings is that they require less lubricant than the plain type and do not require to be oiled so frequently. The total first cost of ball or roller



Bearing factors and their magnitude

bearings should be compared with the total first cost of plain bearings. Decide on a percentage (30 per cent is considered reasonable by some engineers) to charge against the difference in cost. This percentage should be earned annually by the saving that is effected in the cost of power.

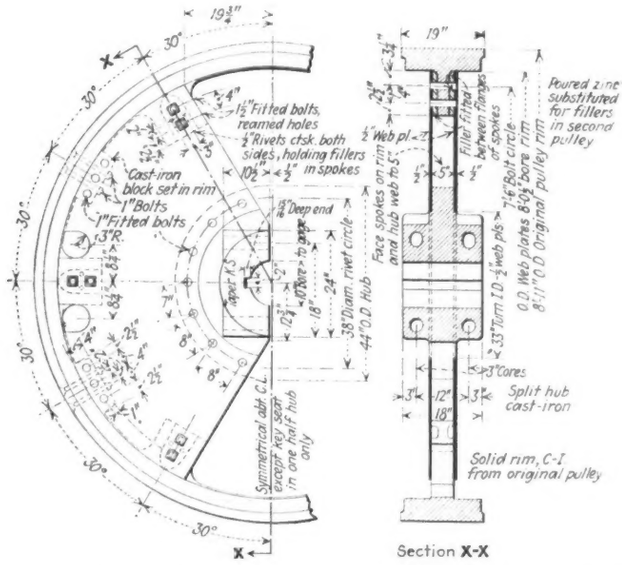
To use the accompanying chart, lay a straight-edge across it three times, as indicated by the dotted lines, and it will give the horsepower required by any bearing; coefficient of friction varying from 0.0006 to 0.6; shaft diameters from 0.1 to 10 in.; r.p.m. from 100 to 10,000, and the load on the bearing from 10 to 10,000 lb. As an example, by using a coefficient of friction of 0.02 (Column A), (average practice for plain bearings), a shaft diameter of 2 in. (Column C), a speed of 2,000 r.p.m. (Column E), and a 400-lb. load on the bearing (Column G), Column D gives the friction horsepower as a little over 0.25. Connect the known value in Column A with that in Column C and locate the intersection with Column B. In the same way connect columns E and G and locate the intersection with Column F. Then connect the intersections (Columns B and F) and the intersection with Column D gives the friction horsepower of the bearing.

Repair of Roll Fly Wheel Pulley

By W. J. Tait

The roll pulley shown in the accompanying illustration is a web center type rebuilt from the salvage parts of an older pulley. The older pulley was of cast iron with a split hub to facilitate removal from the shaft when changing shells. Its arms were of I-section and had failed by cracking near the hub. It seemed that a web center would overcome such trouble, and this design was made to utilize the old rim and certain plate sizes in stock.

A new hub in two parts was cast with a central flange; the pulley arms were cut off and faced on both sides for double web plates; and fillers fitted into the arms and between them to allow the attachment of the web to the rim. Holes for the attachment of slings for handling were left in the webs as shown. Their location was determined by certain clearances and positions demanded by repair operations. The hub is clamped together by four 2¾-in. bolts.



Details of design of built-up flywheel pulley

This pulley has been in regular use for the last three years, and another has been made in the last few months. The only change in the later one is the substitution of poured zinc for the fillers between the flanges of the old pulley arms. This seems to give equal satisfaction with less labor and difficulty in fitting up the fillers.

Stockpile Crane

A crane devised by the Great Northern Railway Co. and used all over the Kelly Lake Division is shown in the accompanying pictures. Its main use is in shifting and building tracks at the stockpiles of the various mines on the Mesabi Range, but it is also employed for loading rails, and for handling gravel or other heavy and bulky material.

Stockpile crane mounted on auto truck

This universal crane, which is built at Elyria, Ohio, is mounted on an old Sterling truck with the chassis frame lengthened to form a wheelbase of 15 ft. The crane has a capacity of 10,500 lb. at 10 ft. centers or 2,700 lb. at 28 ft., and it can travel over the roads at 20 m.p.h. It has loaded three cars of 30-ft. rails at a rate of 122 rails per hour. Using a half-yard clamshell, it loaded 6,000 cu.yd. of gravel from a pit in three weeks, keeping seven teams busy, and used $78 worth of gasoline. These few jobs are mentioned to show the variety and class of work it can handle and how it might pay for itself around a mine.

Use of Portable Protecting Screens

Accidents, more especially eye accidents, arise where metal chipping and hammer work are in progress. To guard against flying chips and bolt heads, portable screens are in use in the Garfield mills of the Utah Copper Co. These screens are about 6 ft. high, each screen being formed of three hinged divisions so that the work can be surrounded on three sides. The upper part of each division of the screen is formed of fine mesh wire cloth extending from the top of the screen frame to a short distance below the top of the working bench. The arrangement effectively stops all flying particles.

In the electric welding shop a similar screen is used to inclose the work. A black oilcloth is used on the screen compartments and extends from the top to within a short distance of the floor.

News of the Week

The Mining News given in ENGINEERING AND MINING JOURNAL is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Summary

ONTARIO OPERATING costs decline—Flin Flon pilot mill nearing completion—Wright-Hargreaves has extensive development under way.

West End Consolidated ships high-grade ore—Waldron quicksilver mine starts furnace for extraction of mercury.

Transvaal gold production largest in history—Platinum returns low—Sweden reports gold rush.

Silver prices cause depression in Mexican mining—Penrose Mines plans extensive operations at Leadville.

Commerce Mining builds another steel concentrating plant—Hunt Mining Co. wins Oklahoma tax suit.

Potash exploration delayed—Silver situation somewhat brighter; Indian legislature meets in February to act on monetary questions.

Interest in copper in London vies with tin—Soviet Russia not disposed, according to report, to release nationalized property.

Kirkland Lake Gold reserves in dispute—Paymaster makes 30c. assessment.

East Kootenay's mineral deposits developing rapidly, due to improved transportation.

Ojuela mine adopts selective flotation—Yaqui Indians source of trouble in Sonora.

Comstock Merger to Suspend Operations

Recovery Value of Ore $4.30 Per Ton; Costs $4.05 Per Ton, Not Including Development Work

THE Comstock Merger Mines, Inc., of Virginia City, Nev., after a persistent campaign to operate on low-grade ores, has announced its intention to suspend operations in December. This announcement will be received with keen regret by Western mining men, for it was hoped that when the Comstock Merger took over the plants and properties of the United Comstock at practically salvage prices, the new company, being upon a sounder basis than its unfortunate neighbor, would make good and might eventually retrieve its capital investment. The Comstock Merger has had the advantage of an excellent operating staff under the management of Thomas C. Baker, who achieved marked success in the operation of the Fresnillo property in Mexico. Baker initiated close selective mining, and by this succeeded in maintaining a workable grade of ore, although costs were increased where the orebodies were small and scattered over a great distance, necessitating many miles of workings in heavy ground. Separate surface plants and underground organizations, one at the Middle Mines and the other at the Gold Hill group, added to the total of working expenses. The result of exploration in the Middle Mines group indicated the need for cautious operation. Capital input for necessary improvements was restricted to a minimum and to absolute necessities. Methods were extemporized to fit this situation, although in some instances higher costs were the resultant of this practice. Nevertheless, it is stated that up to the close of operations about 950,000 tons of ore yielding an average recovery of $4.30 per ton was milled at an average cost of $4.05 per ton, which figure, however, excludes exploration and preparation expenditures of the Middle Mines group. The United Comstock handled somewhat less than 1,000,000 tons, so that the total tonnage mined and milled from the two groups was about 1,900,000 tons.

Failure did not result because costs were higher than estimated, but principally because ore grades were much lower than was indicated by careful sampling of what at the time appeared to be a sufficient number of crosscuts. It was realized soon after stoping operations were started that the grade of ore indicated was restricted to that extracted in the development work and that above or below or to one side of a crosscut the fill might have a different value. The loose character of the fills prohibited vertical development in them, and the absence of such workings was undoubtedly the cause of misleading results in sampling. In this instance fills were apparently laid down in horizontal layers, and raises, by intersecting the various layers of the fill, would have given a better idea of conditions than crosscuts, which are restricted within the horizontal beds of the filling.

Over a year ago the company, realizing the futility of attempting to recover its investment from the mining of the old filled stopes, initiated a campaign of exploration work in the hope of finding new orebodies. A tremendous amount of work was accomplished, but none gave the slightest encouragement. The United Comstock explored for new orebodies, but did not discover any. Apparently there is no such thing as a low-grade orebody on the Comstock, or the early miners mined to limits below which efficient operation is not possible today. Bonanza orebodies ended abruptly with little or nothing to indicate their condition short distances beyond the limits to which they were stoped. As a consequence exploration operations are a blind gamble.

Undoubtedly this company could have prolonged its existence were it not for the recent and very drastic drop in the price of silver. As the outlook does not appear to be specially promising, the probability of the company's resuming operations in the future under better conditions is apparently remote. As an instance of local difficulties encountered by this company, it is of interest to note that although the United Comstock mill was obtained at a cost of $325,000, after deducting quick assets from the purchase price it was assessed at a value of $960,000 for local taxes.

Notices were posted Oct. 19 at the Virginia City and Gold Hill mines of the Comstock Merger Mines, Inc., advising its 500 employees to seek new jobs by Dec. 15. Officials state the company lost fully $200,000 last year and has been losing heavily for many months. There is little possibility of a resumption of work unless silver goes to 75c. an ounce.

Ojuela Mine Starts Selective Flotation Mill

The Cia. Minera de Peñoles, Mapimi, Durango, Mexico, recently started its 250-ton selective-flotation plant to treat silver-lead-zinc ore from the Ojuela mine. No milling has been done at this mine before, all of the ore having been shipped direct to the smelter.

News From Washington

By PAUL WOOTON
Special Correspondent

Potash Exploration Delayed Pending Clarification of Legal Verbiage —Silver Situation Somewhat Brighter

Members of Congress interested in potash exploration think some of the departmental lawyers are in error in interpreting the potash act to require that the government be reimbursed for its exploratory expenditures, even if there is failure to find potash. It was obviously the intent of Congress to provide for reimbursement from royalties only. The contract which has been laid before land owners in the vicinity of the drilling sites selected in Texas requires reimbursement for the expenses incurred by the government, even if no potash should be found. No one will sign such a contract.

The law provides that the contract shall require the owners within a radius of one mile to pay to the government "an amount equal to the actual costs of said explorations." The act provides, further, however, that "said payments are to be made at such times, in such manner, and in such proportions as the secretaries, in their discretion, may determine to be equitable." The opinion on Capitol Hill is that this language, particularly when considered in connection with the record of the hearings and the statements made on the floor, justifies the drawing of a contract providing for reimbursement out of any royalties that might accrue to the land owners. It is understood that Senator Shepperd, the author of the bill, will urge the Department of Justice to clear up the legal question involved at the earliest possible moment so that drilling in Texas may proceed.

In view of the impossibility of proceeding with drilling at any one of the sites in Texas certified by the Geological Survey, the Bureau of Mines is turning to public lands in New Mexico, and the probabilities are that drilling there will be begun within a month. Even on the public lands there are difficulties to be overcome. In the zones where the occurrence of potash is most likely it is hard to find a point where the one-mile radius does not cut into privately owned land or a school district.

The Silver Situation

The future of silver is not so dark as some are painting it. Information reaching Washington is to the effect that the recommendations of the Royal Indian Currency Commission probably will not be put into effect.

The emphasis placed by the commission on its prediction that the change to the gold standard in India would not depress the price of silver below 24d. has detracted from its influence. The price fell below that figure before the recommendations had been acted upon and before there was any assurance that they would be adopted.

Apparently one of the principal objectives of the Indian Legislature, which meets in February, will be the enactment of legislation calculated to strengthen the position of silver—the country's primary monetary metal. With the savings of the people almost entirely in silver it is thought that no step will be taken to impair the purchasing power of those savings.

On the other hand, it is recognized that the production of silver at the present rate is in excess of the demand. The fall in price will reduce production somewhat, it is expected, but the real need, it is declared, is to increase the use of silver. Under existing conditions there should be renewed effort to develop a silver alloy which does not tarnish. When such a discovery is made from 30,000,000 to 90,000,000 additional ounces of silver will probably be used.

Increase in India's Silver Coin Reserve

ADVICES from Bombay to the U. S. Department of Commerce indicate that silver coin in the Indian currency reserve amounted on Oct. 15 to 948,800,000 rupees, an increase of 1,300,000 rupees over the week previous. There was no change in the bullion in reserve. Silver stocks in Bombay on Oct. 23 amounted to about 2,700 bars, a decline of about 600 bars during the week.

Railroad Transportation in Sonora Hindered by Rains and Yaquis

Transportation service in northern Mexico is in a bad condition, due to heavy rains causing washouts, especially in Sonora. In addition to the damage done by the rains, the Yaqui Indians have burned many bridges between Guaymos and Rio Yaqui. Railroad officials say it will be at least two months before trains on some of the lines will again be running on schedule. There are about 2,000 Yaquis engaged in guerrilla warfare, against which the government has dispatched 20,000 soldiers in an endeavor to put an end to their depredations.

Commerce Mining to Construct New Mill on Blue Goose Lease

Steel has been ordered for a second steel concentrator for the Joplin-Miami district by the Commerce Mining & Royalty Co., Miami, Okla., to replace the wooden mill on the Blue Goose lease near Cardin, destroyed some weeks ago by fire. The Blue Goose mine has been one of the largest producers in the Oklahoma section of the Joplin-Miami district, but recent drilling has indicated large quantities of ore still untouched, and the company feels justified in constructing a new and expensive mill to replace the one destroyed.

The district's first steel mill was completed only a short time ago by the Anna Beaver Mining Co.

Several smaller mills are under construction in the district. Sam Abrams and associates are building a mill on the Shapp land, south of Lincolnville. The Huttig Lead & Zinc Co. is completing a new mill on the Beck lease, south of St. Louis, Okla. Gus Mattes and associates, of Joplin, are building a mill on the Diamond Joe lease, south of Baxter Springs, Kan.

Oklahoma Cannot Tax Ore Taken from Indian Lands

The Hunt Mining Co., and the Black Hawk Mining Co., in the Joplin-Miami district, have been awarded refund of taxes assessed on ore in bins the first of the year, by the district court at Miami, Okla. The award was made following announcement of the decision of the U. S. Supreme Court in the case of the Jaybird Mining Co., of this field, which sought refund from similar taxes on the ground that the State of Oklahoma has no right to tax ore taken from Indian lands. The district court decided in favor of the Jaybird company, but the state supreme court overruled the decision. The case was then carried to the U. S. Supreme Court, where the company won once more.

The Hunt company will have returned to it $1,066.15 and the Black Hawk $1,606.80. The Jaybird company got back $2,350. All three cases have been pending for some time.

West End Ships High-Grade Ore from Mabel Mine

The West End Consolidated Mining Co., Tonopah, Nev., has shipped the 64th car of ore from its Mabel mine, 20 miles from Mina, Nev. Returns on this 38-ton car were as follows: gold, 2.28 [illegible]; silver, 297.72 oz.; and lead, 15.85 per cent. The gross value of the ore was approximately $224 per ton. This is the highest-grade lot the company has shipped from the Mabel mine, the previous high being $183 per ton, with silver at a much better price than at present.

Mine Sales a Feature in Joplin-Miami District

Although there is no feverish activity in the Joplin-Miami zinc and lead district, steady production and sales of small mines are frequently reported.

A. C. Jones and associates, of Chicago, recently purchased the E. F. & G. mine, on East Twentieth St., in Joplin. This mine is known as the Clear-Peacher, and has been a steady producer of silicate ore for several years. Its new owners are planning to make improvements to the mill and to increase production.

The Kansas Exploration Co. has purchased the 40-acre fee on which the St. Louis Smelting & Refining Co. formerly operated its No. 1 mill in this district. The purchase followed a drilling campaign of some months.

Government Roads Aid Alaska Mining

The government road-building program is making more accessible the remote mining regions in Alaska. These highways now total nearly one thousand miles, including 400 miles between Valdez and Fairbanks and about 105 miles of road being laid from Chatanika to a point on the Yukon River yet to be designated.

Seafoam Mines Storing Ore for Spring Shipment

Walter Hovey Hill, manager of the Seafoam Mines Corporation, Boise, Idaho, with property situated on Harlan Creek, in the Seafoam mining district in Custer County, Idaho, has returned to the mine. Mr. Hill had twenty men employed on development during the summer, and will work ten men throughout the winter, stoping ore and sorting high-grade for shipment next spring. The camp is modern in every respect, with hot and cold water supply, telephone and radio, and a dog train will bring in the mail weekly during the winter from Stanley. Improvements early next spring include a 250 hp. hydro-electric plant, a four-mile transmission line, a 200-ft. compressor, and an all-sliming 50-ton pilot mill.

Santa Anita Changes Ownership

Controlling interest in the Santa Anita Mining Co., Radersburg, Mont., has been sold by J. L. Templeman, Dr. T. B. Moore, and associates, of Butte, to George A. Wins'ow, an operator in the Radersburg district. The property consists of three patented claims, the ore being lead-silver. The last car shipped netted $3,071 and assayed 10.9 oz. silver per ton and 47.9 per cent lead. Mr. Winslow will immediately operate the property. J. L. Templeman, who negotiated the transfer of the property, is one of the attorneys of the W. A. Clark estate, Butte.

Silver Mining in Mexico Affected by Decline in Silver Prices

The rapid decline in silver prices has brought about a serious situation in the Mexican silver mining industry, according to a report to the U. S. Department of Commerce. During recent years the total value of silver produced annually is approximately one-half of the total value of all metals produced annually in Mexico.

During the calendar year 1925, the total exports of unworked silver amounted to 125,744,287 pesos, out of total exports for the year of 682,484,832 pesos. Mining men estimate that Mexico's silver production may be reduced approximately 20 per cent if the present low price of silver continues.

The mining regions affected principally by the drop in silver prices are Pachuca, Guanajuato, and Zacatecas, where silver is the only metal produced in important quantities. It is estimated that approximately 60 per cent of Mexico's silver production comes from these regions. Mining companies at these points already have taken steps to reduce their personnel, and are abandoning the veins producing low-grade ores. The remaining 40 per cent of Mexico's silver production comes from mining centers in the northern part of the country, such as Chihuahua, Coahuila, Sonora, and Durango, where silver is produced as a byproduct from other metals, such as lead and zinc. Owing to the satisfactory prices still prevailing in the lead and zinc markets, it is improbable that the mines in the northern part of the republic will be much affected by the present low silver prices.

Simsburg Copper Mine Sold at Auction

The old Simsburg copper mine, worked prior to the American Revolution, was sold at auction Oct. 23, 1926. The property is near East Granby, Conn., and on Dec. 22, 1773, John Hinson served as the first inmate, shortly after the colony acquired the mine for "a public gaol and workhouse." It was used as a prison ("Newgate prison") for forty-six years. Many of the prisoners were Tories.

Penrose Mines to Develop Down Town Basin, Leadville

The filing of articles of incorporation by the Penrose Mines, Inc., marks the beginning of another epoch of activity in the famous Down Town basin, at Leadville, Colo. It has been known for some time that plans have been under way for a resumption of operations in this particular section of the Leadville district by St. Louis and Chicago capital, but it has required considerable time to get together the desired acreage.

The moving spirits in the organization of the Penrose Mines are C. J. Walker, of St. Louis, and ex-Governor Jesse F. McDonald, of Leadville, who have long realized the opportunities of this area.

The new company, using the Penrose as the base of operations, will install a modern electrical pumping equipment. The water in the Penrose shaft, which is 875 ft. deep, is 390 ft. from the surface.

Present plans contemplate the resumption of pumping by the first of the year, but this will depend on various contingencies, including the question of power, that will have to be worked out later.

Lutze Property Under Five-Year Lease

The Lutze property, 25 miles northeast of Colville, Stevens County, Wash., has been taken over under a $60,000 bond and five-year lease. The Van Stone Lead-Silver Mining Co., of Spokane, has been incorporated to handle it. It is said that the property has an unusually good surface showing of rich galena outcropping for 2,000 ft. Charles H. Foreman and J. M. Plumlee, of Burke, Idaho, both employed by the Hecla Mining Co., and H. E. Putnam, also of Burke, took the bond, and with Jasper Hames, of Spokane, have organized the company and started to crosscut to the vein.

Quincy Mine Has Good Ore on 87th Level

At the Quincy mine, Hancock, Mich., the east vein, which became suddenly enriched at depth, is opening up with satisfactory values in the 86th and 87th levels of No. 2 shaft. Developments in this formation will be below the 80th level in both Nos. 2 and 6 shafts. The vein is being opened in conjunction with major operations on the Pewabic, which is holding up well in the bottom drifts.

Arcadian Consolidated Unwatering New Baltic Shaft

Arcadian Consolidated, Hancock, Mich., which is about ready to start pumping in its New Baltic shaft, will drift south on the 942-ft. level as soon as the water is lowered to that depth to connect with the corresponding level from the New Arcadian shaft. Good copper stretches have been opened in New Baltic and the vein gives promise at greater depth. Milling and smelting facilities within a few miles of the mine are available to Arcadian when openings are extensive enough to warrant production.

Calumet & Hecla to Reopen Avery Shaft

In the Michigan copper district, Calumet & Hecla has started its exploratory crosscut from No. 2, Allouez shaft, at a depth of 500 ft., and preparations to reopen the old Avery shaft of the Cliff property in Keweenaw County, Michigan, are well under way. This shaft will be used as the center of an important exploratory project. Men are engaged in cleaning up about the mouth of the shaft and laying foundations for electric pumps. A power line is being built from Ahmeek to the shaft.

The Avery is 900 ft. in depth and was opened on a fissure vein. Although not worked for many years, it is still in good condition.

Magnetite Deposits to Be Developed

The West Coast Iron & Steel Co., 115 Broadway, New York, N. Y., has been organized to develop certain magnetite iron properties on the west coast of Prince of Wales Island, Alaska. The company owns or controls the Jumbo group, consisting of 70 claims; Hetta group, 20 claims; Vesta group, 10 claims; Green Monster group, 14 claims; Copper Bluff group, 6 claims, and the Alaskan group, consisting of 5 claims.

The company proposes to develop an iron and steel industry on the property, where it is said ample hydro-electric power is available.

Andes Copper Miners Strike

The sudden death in jail of a miner who had been arrested has resulted in the declaration of a general strike of the workers at Potrerillos mine, Potrerillos, Atacama district, Chile, belonging to the Andes Copper Co., owned by the Anaconda Copper Mining Co. Six thousand workers are affected.

Waldron Quicksilver Mine Operating Furnace

The Waldron quicksilver mine, in the Terlingua district (Alpine P. O.) Texas, has completed and started a 12-ton furnace for the extraction of mercury. The property is 90 miles from the railroad, and consists of eight claims on which about 3,000 ft. of development work has been done. The deepest working is 150 ft., but at present the bulk of the ore comes from an adit, the equivalent of the 75-ft. level. All ore is hand sorted and hauled by mules over an 18-in. gage track from the mine to bins at the furnace, a distance of 1,200 ft. The property has been developed by E. A. Waldron to its present stage without the aid of outside capital.

Sorting patio and entrance to Waldron mine

Injunction Against Shattuck-Denn Corporation Denied

The injunction asked for by a minority stockholder of the Shattuck-Arizona Copper Co. to prevent the new company, Shattuck - Denn Mining Corporation, Bisbee, Ariz., from taking over the property of the former company has been denied by the Duluth (Minnesota) district court. The case was appealed to the Minnesota Supreme Court, and the decision of the lower court was sustained. The suit was filed Nov. 17, 1925, when the Denn and Shattuck companies were being merged.

New Stock Exchange for Spokane

A new stock exchange, named the Standard Stock Exchange of Spokane, was organized recently at Spokane, Wash. The board of governors consists of Edward Pohlman, president; E. J. Gibson, vice-president; H. W. Fairbanks, treasurer; Edwin T. Lavigne, secretary, and Chester H. Harvey. The membership will be limited to fifteen the first year.

"The principal object of the new exchange," said President Pohlman, "is the promotion and advancement of legitimate mining in the Northwest. With this purpose in view securities listed on the new exchange will be limited strictly to those of companies making adequate and regular reports to the stock exchange and their shareholders of company operations and finances. These listing requirements will be enforced with the utmost impartiality, having particularly in mind, in the case of mining companies, regular submission of complete financial statements and development reports for the guidance of the investing public.

"The proposed constitution and by-laws have been modeled on those of the New York Curb Market association, and embody many rigid requirements controlling methods of trading, listing of securities and conduct of members."

Iva Fern Bonded for $125,000

A. E. Place and associates, of Los Angeles, have bonded the Iva Fern group, at Cultrus Creek, Kootenay Lake, B. C., for $125,000 and have paid a first installment on the property. The Iva Fern was bonded by the Consolidated Mining & Smelting Co. of Canada, six years ago and a good deal of work was done before the bond was relinquished. Later the Standard Silver-Lead Mining Co. explored the property for about a year, and also did a considerable amount of work. Some extensive bodies of silver-lead-zinc ore have been opened, but a good deal of money will have to be spent on transportation facilities, mill, and the development of a power plant.

Pioneer Syndicate Acquires Robb-Dean Property

The Huronian Belt Co., through its subsidiary, the Pioneer Syndicate, has taken over on option the Robb-Dean property in Malartic Township, Quebec, comprising about 500 acres. Operations last fall disclosed seven feet in width of good commercial ore, which has been uncovered for a distance of 600 ft.

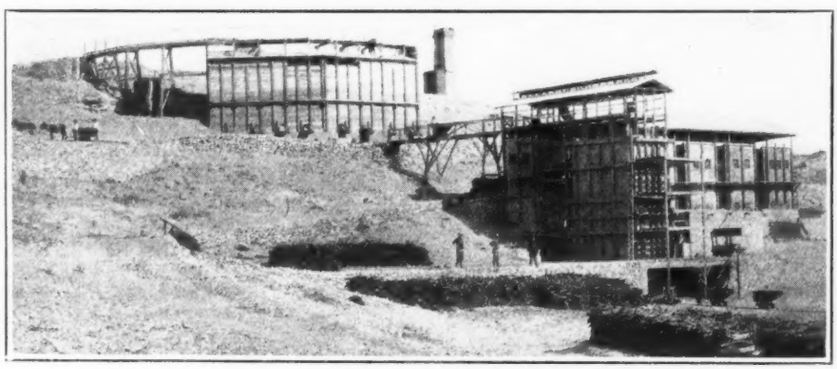
Drop in Silver Prices Felt at Mexican Mines

The crisis throughout parts of Mexico where silver mining operations are conducted has become so acute owing to the drop in silver that the National Mining Chamber of Commerce has presented a memorial to the government pointing out that unless some remedial steps are taken the industry may fall to such an extent as to make future recovery almost impossible. It is believed that the government, as a temporary palliative, may reduce present taxation to make it possible for the industry to continue, even if not on a profitable basis, pending some improvement in the world markets.

Lake Superior Steel Foundry

The Lake Superior Steel Foundry Co. has been organized with offices at Duluth, Minn., to take over the plant of the Imperial Iron Works and enter into the manufacture of steel castings. It is expected that it will be in full operation by Jan. 1. Allan J. Bakewell, of Joliet, Ill., brother of D. C. Bakewell, head of the Duquesne Steel Foundry Co., of Pittsburgh, will be the manager of the company. Its incorporators are Julius H. Barnes, D. C. Bakewell, E. C. Congdon, and Ward Ames.

The plant taken over was founded by the Wessinger Bros. in 1912, and it later became the Imperial Iron works when it was purchased by Mr. Barnes and associates to make castings for the McDougall-Duluth shipyards during the war. When the shipyards were closed in 1920 the foundry plant also became idle. The foundry will serve a large territory in the Northwest, as it is the only one of its kind at the head of the Lakes.



Ore bin and retorting furnace, Waldron mine

Consolidated Mining & Smelting to Add Cadmium Refinery

The Consolidated Mining & Smelting Co. of Canada will add a cadmium refinery to its Trail, B. C., plant. In the zinc plant the cadmium is removed from the solution before the zinc is precipitated electrolytically. A large accumulation of this material has been set aside for future treatment.

The Electrolytic Zinc Co. of Australia is said to have met with considerable success in manufacturing a zinc-cadmium solder, the proportions of which, however, have not been announced.

Extension of Quebec Copper Zone Sought in Ontario

Working on the belief that the Quebec copper zone extends across the boundary into Ontario, prospectors have been showing unusual interest in the country lying between Larder and Abitibi Lakes. Stakings are reported in five townships of Ontario lying along or near the interprovincial boundary. These are Marriott, Ben Nevis, Clifford, Pontiac, and Tannahill. In Marriott, a copper sulphide deposit is reported and a number of parties have been staking claims. In Clifford Township an orebody said to be disseminated copper and molybdenite is the center of attraction. Finds in Ben Nevis Township during the summer were of copper, zinc and galena.

Wright-Hargreaves Expands on Developments

At the Wright-Hargreaves, Kirkland Lake, Ontario, the No. 1 or north shaft has been connected, on the 1,250 level, with the south or main shaft. This gives the mine two shafts at that horizon about 500 ft. apart, located on separate veins which parallel each other. The two shafts have been connected by crosscuts at several levels; and the mine is thus provided with shaft facilities capable of supplying the mill with 800 to 1,000 tons of ore daily. At the 1,250 level a hoist will be installed and a large three-compartment shaft will be put down to lower depths, which can be accomplished without interference with operations above the 1,250 level. Additional compressor equipment is being installed on the surface, and the program for underground development work will be considerably expanded.

Ontario Operating Costs Lower Than in Former Years

An investigation into the costs of mining and milling in the silver-producing areas of Ontario has shown that operating expenses are lower than at any previous time. This has been brought about by the improvement of mining and milling methods, the decreased cost of supplies, and the greater efficiency of labor. In the older sections of Cobalt, however, owing to the exhaustion of high-grade ore and a decreased tonnage of low-grade, costs are at a higher figure. The newer mines in the South Lorrain and Gowganda areas are better able to meet the situation caused by the low price of the metal. Such mines as Keeley, Castle Trethewey, Canadian Lorrain, and Tonopah Canadian could carry on operation profitably with silver at a much lower price.

Wigwam Silver Seized for Money Due on Contract

All the assets of the Wigwam Silver Mines, Ltd., operating at Gowganda, Ont., consisting of mine supplies, plant, and equipment, have been seized under a writ of execution, and are to be offered at a sheriff's sale. The writ was issued on behalf of John Hughes, who has been doing the mining work for the company under a contract. His claim is said to be something over $8,000. The seizure does not effect the claims, as the title for these has not as yet passed over to the company. These claims are understood to have been held under an agreement which, it is said, has not been complied with. It is learned, however, that Montreal interests are likely to furnish the capital necessary to clear off the company's liabilities and to permit resumption of operations.

Canadian Feldspar Production Declines

REVISED STATISTICS issued by the Dominion Bureau of Statistics at Ottawa show that the production of feldspar in Canada declined in 1925 to 28,681 tons, valued at $235,789, a falling off of 16,123 tons and $122,751 from the high level of 44,804 tons at $358,540 established in 1924. The total capital invested by the 23 firms operating in this industry during 1925 amounted to $712,329. Employment statistics showed 11 salaried employees and 229 wage-earners on the payroll during the year. Their earnings totaled $165,766.

Clearwater Lake Attracting Prospectors

The principal center of attraction in the Red Lake mining division of Ontario is Clearwater Lake, situated east of Woman Lake. Four Timmins, Ontario, syndicates have a block of 36 claims which show quartz veins below the surface which have been traced for several hundred feet. Samples show assays of about $8 in gold to the ton. Several new syndicates have been formed, and a number of prospectors are on their way to the locality.

Flin Flon Test Mill Nears Completion

Active operations are in progress at the Flin Flon copper mine, in northern Manitoba, and the test mill is now nearing completion. A fleet of six power boats is employed in transporting supplies and materials across Lake Athapapuskow to the Flin Flon. Experts sent out by the company are scouting the Churchill district, searching for power sites, as one of the most important requirements of the mine and the district is an adequate supply of electric power.

Micolithic Company Constructing Mill

As soon as the railroad which the Micolithic Co., of Texas, is constructing from Collado, Texas, to its mica deposits, 6 miles distant, is finished, development of the property will be started on a large scale. The mill that is being constructed at the mines will have a daily capacity of 1,250 tons of raw material. Deposits of mica, feldspar and allied minerals cover 840 acres.

East Kootenay's Mineral Areas Developing Rapidly

East Kootenay, B. C., was first proved as a mineralized area with the shipping of lead ore from the St. Eugene mine, on Moyie Lake, in 1898. The North Star mine, pioneer shipper of lead and zinc in the crude, early worked under the handicap of a long wagon haul and transference of its ore to river steamers plying between Fort Steele and Jennings, Mont., whence its product was conveyed by rail to the smelter at Butte. Immense and easy of access as the East Kootenay orebodies are, notably those of the Sullivan and North Star and Stemwinder mines, there were dark days in the history of the mining industry prior to the application of the flotation process. Today the Sullivan mine ranks with the world's outstanding metalliferous mines. The development by the Porcupine Goldfields Mining Co. in the North Star and Stemwinder is showing up well.

Transportation Key to Development

It may also be mentioned that active diamond-drilling operations are being carried out by the Bennetts, of Minneapolis, to the eastward of and immediately adjoining the Sullivan property. That operation is to be credited to mining successes attained during the last few years, by reason of splendid transportation facilities, the new and profitable treatment of ores, and recognition by cautious, far-sighted, and thoroughly experienced mining men of the fact that the East Kootenays have been shown to constitute a mining field of immense ore deposits. The East Kootenay ores lie deep, and there are but few surface mines in the district. On Bull River, 30 miles east of Cranbrook, less than 6 miles from the Kootenay Central Railway, active prospecting in a body of gray copper has been conducted for a period of three years. Another deposit of gray copper located on Copper Creek near Skookumchuck is responding satisfactorily after several years of exploration. Low-grade copper ore occurs on Whitefish Creek, tributary of the St. Mary's River, and while worthy the attention of capital, it lacks railway facilities. Bodies of silver-lead ore on Hell-roaring Creek, served partly by wagon road and partly by pack trail, are also being worked. Another promising free-milling gold property is situated on Perry Creek. It is quite probable that this mine will soon be on the shipping list. As is to be expected of a district so richly endowed, East Kootenay prospectors are active.

It is too early to predict the future of non-metallic mining in the district. Gypsum is now being mined at Mayook, 10 miles east of Cranbrook, on the B. C. Southern Railway, the Canada Cement Co., of Montreal, taking eighty tons of material per week from its newly acquired property at that point. The Mayook gypsum deposit comprises eleven claims. Two other gypsum deposits are known, one being situated at Wardner, on the B. C. Southern Railway, and the other at Bull River within four miles of rail transportation.

Toronto Letter

By Our Special Correspondent for Northern Ontario

Ore Reserves of Kirkland Lake Gold in Dispute—Teck-Hughes, New Mill Nearing Completion

The recent controversy regarding Kirkland Lake Gold Mines and the Beaver Consolidated Mines has broken out in a new spot, in a dispute between J. B. Tyrrell, of the Kirkland Lake Gold, and M. W. Summerhayes, who was called in by the old Beaver directors to make a report on the Kirkland property. Mr. Summerhayes showed a total of 41,361 tons of developed ore of an average grade of $13.20 and a gross value of $545,320, which was so far below the amount expected by the shareholders and the public that it was somewhat in the nature of a bomb and caused a good deal of consternation. Mr. Summerhayes in his report gives the basis on which he estimated tonnage and tells how he treated "erratic high assays." Mr. Tyrrell takes issue with him on this and states that he has made "arbitrary and unwarranted reductions, both in quantity and value." Mr. Tyrrell also states that the assured ore reserves are over 80,000 tons, of a value of over $1,600,000. In reply, Mr. Summerhayes defends his report and states that even allowing all that Mr. Tyrrell claims it is impossible, using the ordinary methods of engineering calculation, to arrive at any such figure. He suggests the appointment of an "umpire engineer" to make a report and agrees to pay the total expenses if the "umpire" report does not confirm his estimate, rather than Mr. Tyrrell's, provided of course that Mr. Tyrrell will pay for the report if he is wrong. In view of the amount of publicity given the matter, this would appear to be a reasonable course and one which should settle it in the minds of the shareholders.

Teck-Hughes Operating Oil Flotation Mill

The Teck-Hughes, of Kirkland Lake, has started an oil flotation plant in the old mill, which is now treating approximately 160 tons a day. The presence of tellurides in the Kirkland Lake ores makes a satisfactory extraction by ordinary cyanide methods difficult and concentration methods are coming more and more into use. At the Teck-Hughes a concentrate having a grade of approximately $40 a ton is being obtained. This concentrate is given special treatment and returns to the mill circuit. The company has a large tonnage of old tailings impounded for future treatment, but it will be some time before this will be done. When the new mill starts operation, early next year, the present mill will be used for the treatment of ores in the upper parts of the mine and will eventually be used to treat the impounded tailings. Good progress is being made with the new mill. The building is practically completed and machinery is arriving on the ground. The main shaft is being sunk from the 13th to the 19th level, and a new crusher station, ore pockets, and loading station for the 13th level have been completed. The 14th level station has also been cut. Some of the richest ore ever found in the mine was encountered a short time ago in the east drift on the 11th level. The ore carries a good deal of free gold as well as tellurides, and when first encountered the face of the drift ran several hundred dollars a ton. An orebody 200 ft. long has also been opened up on the west end of the 12th level, but has not yet been located on either the 11th or 13th level.

Paymaster Makes 30c. Assessment

The Paymaster Mines, of Porcupine, is making assessment No. 13, for 30c. a share, and the management expects that no future assessment will be necessary. With the money expended from this assessment the management promises a mill of 2,000 tons' capacity a day. It is expected that a 1,200-ton mill will be in operation by Sept. 1, 1927, and the 2,000-ton plant on June 1, 1928. It is estimated that the 1,200-ton plant can earn approximately $300,000 a year and the 2,000-ton plant $600,000 a year. The present mill is treating approximately 400 tons a day of low-grade ore.

During the month of September, the Vipond mill, of Porcupine, treated 8,503 tons and produced $61,500, an average recovery of $7.23 a ton. This shows that 283 tons a day was milled, but the grade compares with $8 and $9 ore, which was the average when the mill was handling only 160 tons a day.

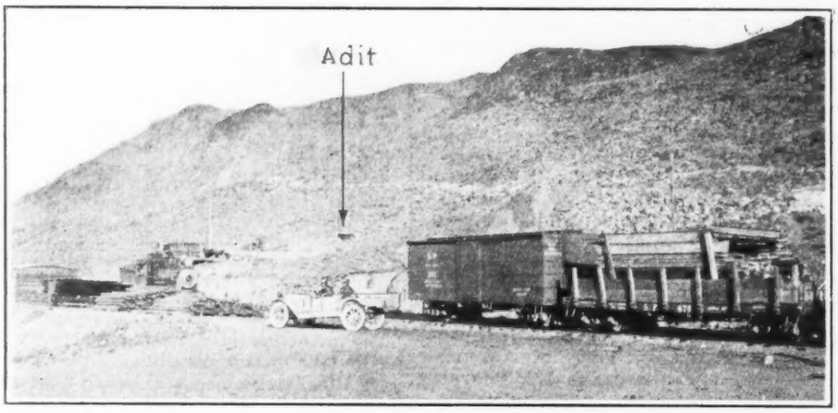
At the Tough-Oakes property high-grade ore has now been opened up, both east and west of the diabase dike on the 1,350-ft. level. The mill is now handling 160 tons a day, and the returns are more than meeting all the operating charges.

Howey Red Lake Underwritten

Announcement is made that 1,000,000 shares of the Howey Red Lake Gold Mines has been underwritten by a Canadian and American syndicate and a preliminary offering is being made to the public, at 50c. a share. If this issue meets with a satisfactory reception it will permit the installation of a mining plant and the opening up of the property. Nothing has been done on the ground since the Dome threw up its option some months ago, but the general consensus of opinion is that the Howey is at least a small mine, with possibilities of something more.

Northern Belle Extension Nearing Shipping Stage

After a series of negotiations covering a period of over five years, John H. Winn and W. E. Pomeroy have succeeded in consolidating a number of properties at Candelaria, Nev., into one unit of 440 acres, on which about 10,000 ft. of development work has been done. Some of the veins near the top of the mountain have been worked to a depth of 100 ft., from which it is said more than $200,000 in high-grade ore has been taken. There are two principal veins: one in which copper predominates, and the other of which contains lead-silver. The management is preparing to ship the best grade of ore to the smelter at Wabuska, upon which it has a rate of $1.60 per ton on ore assaying less than $50 per ton. The railroad extends to the property. W. E. Pomeroy is local manager.



Ore bins at railroad siding, Northern Belle Extension Mining Co.

Carson Patent Suit Scheduled for Jan. 17

By order of the master in chancery, H. L. Partridge, of Globe, Ariz., the case of George Campbell Carson, holder of certain smelting patents, against the United Verde Copper Co. and the United Verde Extension Mining Co., was continued until Jan. 17, with the consent of counsel for both sides. Carson is suing for an accounting of profits which he avers the defendant companies have earned by using "metallurgical furnaces of the kind, character, and description patented by him."

Montana Mining Notes

William H. Hax, of Scranton, Pa., and Dr. J. J. Davis, Ernest Dorais, Frances S. Trauerman, and Carl J. Trauerman, all of Butte, have incorporated the Basin Montana Tunnel Co. to take over from William H. Hax 73 claims located on what is known as the Comstock Hill, the west flank of High Ore Gulch, about 2 miles east of Basin.

Alex Walker, L. M. Cobb, and L. C. Chapman, of Butte, have incorporated the Legal Tender Mining Co. to take over and operate the old Legal Tender mine about a quarter mile from the station of Clancy, Jefferson County, Mont.

The Butte Hill Copper Mining Co., Butte, Mont., which is operating north of Walkerville, Mont., reports that the shaft is now 365 ft. deep.

London Letter

By W. A. Doman
Special Correspondent

Copper Interest Revived In London—Rhodesian Asbestos Not Able to Meet Demand

London, Oct. 19.—At the moment copper is vieing with tin for interest. Shares of companies producing the last-named metal are well held, though they are subject to fluctuations in accordance with the variations of the metal price. The highest level reached since my last letter was £321 10s. per ton; today the figure is £314 12s. 6d. Producers of copper have certainly had their hopes raised owing to renewed talk about combination, and it would not be surprising to see tin shares neglected for a time in order that speculators might take a hand in copper shares. Although the Rio Tinto company has been included in the scheme, it seems that the terms have not yet been agreed upon. No one connected with copper-producing companies will discuss the matter; the reply always is "the news is in the press." So far as the press is concerned, the position is unsatisfying.

Max Francke, a partner with A. Chester Beatty, has just returned from a visit to Siberia, where he has examined properties on behalf of the firm. At present he is reticent and will say nothing as to the success or otherwise of his visit.

The Union Minière du Haut-Katanga, which company is included in the copper combine, has just decided to issue 100.000 "privileged" shares, the balance of the 300,000 authorized in 1921. The issue price is 2,580 francs and may be applied for in the proportion of two shares for every fifteen shares held.

Bwana M'Kubwa has issued its first production report. In September the plant ran at about one-third of its capacity, and produced 243 tons of copper ozide, of 80 per cent copper. The estimated production for the current month is 252 tons of copper oxide, equal to 202 tons of copper, and for November 586 tons of oxide, or 466 tons of copper. So far all concerned seem pleased with the result.

M. Krassin is now in London. In a special interview with a representative of *The Financial News* he made it perfectly clear that there was no possibility of nationalized properties being returned. The Soviet Government would consider concessions, but in no circumstances return; so that both mining and oil companies can apparently abandon all hope.

A pool has been formed in London to deal in Lena Goldfields shares. Full particulars are not available, but from what I can gather it is purely a market transaction, and has no reference to profits made by the company. In fact, it is questionable whether profits are being made, seeing that so large a proportion of the gold won accruing to the company has to be utilized in purchasing the depreciated chervonetz and high-priced Russian commodities.

At the annual meeting of the Rhodesian & General Asbestos Corporation, Edmund Davis had a very fine story to tell. The profit for the year was about £100,000 higher at £223,241 and the dividend is maintained at 20 per cent, although on a very much larger capital. The principal asbestos property is the Shabanie, in Rhodesia. This Mr. Davis describes as "a magnificent proposition—so far as we know the richest in the world." Unfortunately, the supply of asbestos is at present unequal to the demand owing to lack of power, but a gas producer plant is being erected in four units of 325 hp. each. Another drawback to Shabanie is the distance from the railway and an arrangement has now been made with the Rhodesia Railways for the construction of a line 63 miles long from Somabula to Shabanie, and work has already been started. Invitations have been sent to the directors to amalgamate with other producers, but Edmund Davis states that the board would not be a party to giving absolute control of the company's sales to any group in the United States or elsewhere. A great future is predicted for the company.

Reported Gold Discovery in Central Sweden

A gold rush on the Alaskan style is reported from Skelleftea, Sweden, following the discoveries of orebodies in the Province of Vasterbotten. The list of minerals they contain includes copper, zinc, arsenic, silver, and gold.

At Boliden, where most of the gold is found, mining has started. New buildings are springing up at a rapid pace. Plans for an entire city have been laid out about the village nearest the mine. The ore was discovered by new electrical prospecting methods. The Swedish Government is said to have appropriated further funds for a continued systematic search.

Canfield Mineral Collection Given to Smithsonian

The Frederick Canfield collection of about 9,000 minerals, among the largest and most complete private collections in this country, accompanied by an endowment of $50,000 to be used for its increase, has been given to the Smithsonian Institution, Washington, D. C. Frederick Alexander Canfield, of Mine Hill, N. J., who died last July, was the donor of the collection, which is in two sections. The older section was gathered by Dr. Canfield's father some time before the middle of the last century. It contains many specimens found early in the history of the country in mines which long since have shut down and specimens from which are, consequently, no longer available.

The son began his own collection, which constitutes the second section of the legacy. Its value is as great and it is of as noteworthy interest as that of the elder Canfield. It is the result of the expert discretion with which the younger Canfield, himself a mining engineer, used his means to gather mineral specimens from all parts of the world.

Johannesburg Letter

By John Watson
Special Correspondent

Transvaal Gold Production Exceeds That of Last Year—Platinum Disappointing

Johannesburg, Sept. 28.—The Transvaal Chamber of Mines has issued an analysis showing that, for the first eight months of 1926 the total production of gold reached a value of £27,594,817, which is an increase of £727,177 over the corresponding period of 1925.

Last week, the Union Corporation, Ltd., issued the following statement: "The Government of the Union of South Africa has accepted a tender of the Union Corporation, Ltd., for a lease of 2,641 claims on the farm Geduld, adjoining the Geduld Proprietary Mines property to the east. Arrangements have been made with the Geduld P. M., Ltd., whereby it secures an interest in this business equal to that of the Union Corporation, Ltd., and gives adequate facilities for the opening up of a large part of the lease area through its workings." On three previous occasions, during the last nine years, the Geduld East area has been offered for lease. The Union Corporation, Ltd., has previously submitted two tenders, one of which was conditional on investigation being permitted. This principle was then objected to by the government; but has since been admitted in the case of the Sub-Nigel's lease of the Grootfontein area.

Platinum Returns Low

Transvaal Platinum, Ltd., reports that its reduction plant milled 632 tons during August. The crude platinum produced is estimated to contain 98 oz. of platinoid metals. In view of the disappointing values disclosed by recent development, and the fact that milling results have not in general confirmed the estimated development values, the consulting engineer recommends the suspension of milling operations. Funds are practically exhausted, and the board has decided to close down the plant immediately. A full report to shareholders will be issued soon.

The director of the Gold Coast Geological survey (Mr. Kitson), lecturing in London last week, said that near Mamkwadi he found a large dike of mineralized hornblende rock. Samples of this were assayed, and eight assays showed platinum from 3.6 to 6 grains per ton. The lecturer suggested the possibility of richer material being found, as there were a great number of untested dikes of similar formation.

On the Johannesburg Stock Exchange, the share market was active, and a fairly large turnover was effected. Crown Mines have improved during the week from 67s. 3d. to 69s., in spite of London selling these heavily. Gedulds improved from 84s. 6d. to 85s. Land and platinum shares were quiet; Transvaal Estate and Development, however, show a rise of 1s. on the week's balance.

Societies, Addresses, and Reports

Jackling Receives Gold Medal

Award by Mining and Metallurgical Society of America—Acclaimed by Distinguished Gathering

By A. B. Parsons
Assistant Editor

MEN are not rare who can do big things well when they are given a pattern to follow. When an individual does something that has never been done before, that is achievement; but when he does it in the face of the almost unanimous verdict, of those best qualified to judge, that it cannot be done at all, that certainly is a mark of genius. No one will inquire as to what is the distinguished service for which D. C. Jackling was presented the gold medal of the Mining and Metallurgical Society of America at a dinner at the Waldorf on Oct. 28.

Twenty years ago Jackling undertook to tear down a mountain of rock containing twenty to thirty pounds of sulphide copper per ton; to crush the rock and recover the copper; and, most important of all, to do this at a good profit. No one else combined the imagination and vision to see the economies of large-scale operations with the personality and capacity to enlist the millions of dollars necessary to finance the project. Jackling had these, and he had the creative and organizing ability and the energy to carry out his ambitious program. He became the pioneer in the exploitation of low-grade copper ores.

Today one-third of the world's copper comes from ores that were valueless twenty years ago. Jackling himself and many others have developed and improved the methods, but Jackling showed the world how it could be done. There are no counter claimants; Jackling is recognized as the man who made the pattern at Bingham canyon.

The award was made as a result of a virtually unanimous letter ballot of all the members of the society; and the presentation ceremony was attended by 150 members and friends that included leaders in the non-ferrous metal-mining industry throughout America.

Communications by letter and telegraph from various individuals and societies were first read by Clinton H. Crane, president of the Mining and Metallurgical Society and toastmaster of the evening. From a sheaf, that he said would take the entire evening to read, Mr. Crane selected about a dozen, including congratulatory messages from Herbert Hoover, George Dern, governor of Utah and a mining engineer, Senators Smoot and King, from Utah, John Hays Hammond, Spencer Penrose, Eugene Meyer, Jr., the Institution of Mining and Metallurgy of London and the Canadian Institute of Mining and Metallurgy.

D. C. Jackling

Charles Hayden, who has financed the Jackling companies — Utah, Nevada Consolidated, Ray and Chino—said that the 20 years since he has been associated with "my friend Jack" were the happiest in his banking career. A banker faces enough elements of uncertainty in any venture; and he is indeed fortunate when he can eliminate one great risk—by having implicit reliance in the absolute integrity of the individual whom he is backing. He traced the growth of the porphyries from "mountains or barren deserts of refuse" to remarkable copper mines. Including Kennecott and Braden, of the operating board of which Jackling is chairman, the copper companies which he directs are producing 750,000,000 lb. of metal every year. Utah in September earned $1,300,000 by producing copper from 0.99 per cent ore at a cost of 7.46c. per pound.

One great achievement, he said, was the building of a large technical and executive staff that is without a superior. Jackling he calls the "greatest mining operating executive the world has ever known."

Bernard M. Baruch, who headed the raw materials division of the War Industries Board in 1918, told how a deadlock had been reached between the American manufacturers of powder, and the U. S. Army, Navy, and the allied governments. The crisis was serious. Mr. Baruch told President Wilson that Jackling would solve the problem if it was solvable. He telephoned Jackling at San Francisco and Jackling protested on the ground that he knew nothing of making powder; but so insistent was the call that he started for Washington the next morning. "They tried to put a uniform on him," said Mr. Baruch, "but fortunately they failed, and Jackling succeeded in keeping full command of the situation."

Ground was broken for two huge plants in March; on July 13 sorely needed powder was being produced!

These Men Met to Honor D. C. Jackling, Medalist of Mining and Metallurgical Society

A
Adams, Huntington
Aldrich, Charles H.
Aldrich, Sherwood
Aldridge, Walter H.
Austin, C. A.
Ayer, Chas. F.

B
Bacon, Raymond F.
Baker, Cecil
Ball, S. H.
Bain, H. Foster
Baragwanath, J. G.
Barbour, Col. P. E.
Bartholomew, Geo. P.
Baruch, B. M.
Bates, Bennett R.
Beatty, J. B.
Beckett, P. G.
Bellinger, H. C.
Bennett, W. E.
Berkey, Chas. P.
Berry, Edwin S.
Birch, Stephen
Boyd, W. S.
Brennon, J. C.
Bridgman, G. Temple
Brown, Wylie
Brownell, F. H.
Brush, H. M.

C
Case, Charles C.
Calderon, A. Alverez
Callbreath, J. F.
Cates, Louis S.
Catlin, R. M.
Church, John A., Jr.
Clark, Edw. H.
Clendenin, Jos.
Colcord, F. F.
Colpitts, W. W.
Corlies, H. D.
Cornell, I. H.
Cotton, Jos. B.
Coverdale, W. H.
Cowan, A. W.
Cox, W. Rowland
Craig, E. J.
Crane, Clinton H.

D
Daveler, E. V.
Deacon, R. W.
Dodge, C. E.
Dodge, H. E.
Dorr, J. V. N.
Dorr, G. H.
Doubleday, George
Douglas, Archibald
Douglas, Walter
Dwight, Col. A. S.

E
Earl, Charles
Easley, Geo. A.

F
Fay, A. H.
Ferber, A. J.
Fernald, H. B.
Fox, H. W.
Fozard, James L.

G
Goodwin, R. F.
Grant, Hon. Robt. J.
Graves, Jay P.
Gruver, E. L.
Guess, H. A.
Guggenheim, Edmond A.
Guggenheim, Murry
Guggenheim, Hon. Simon
Guggenheim, S. R.

H
Hayden, Charles
Hochschild, H. K.
Homer, D. D.
Hoyt, R. F.
Hubbell, A. H.
Holland, Alfred

I
Ingalls, W. R.
Inslee, J. A.

J
James, Alfred
Janeway, J. H.
Jenkins, C. V.
Jowett, J. H.
Judson, Wilber

K
Keene, A. F.
Kelley, C. F.
Kemp, J. F.
Krumb, Henry

L
Lakenan, C. B.
Leggett, T. H.
Li, K. C.
Lindberg, Carl O.
Lloyd, R. L.
Locke, Augustus
Loeb, Carl M.
Ludlum, A. C.
Lyon, Dorsey A.

M
Macdonald, J. Q.
Masters, H. K.
Mayer, L. W.
McConnell, R. E.
McCune, Rowe
McGowan, J. K.
McNab, A. J.
Motter, W. D. B., Jr.
Moulton, H. G.
Mudd, H. S.

N
Nevius, J. Nelson
Newhouse, Edgar L.
Newhouse, Edgar L., Jr.
Nichols, C. W.

P
Parsons, A. B.
Pearson, R. F.
Perry, Col. O. B.
Pickering, J. C.
Pridham, C. F.
Prosser, H. A.

R
Raiff, F. R.
Raymond, R. M.
Read, T. T.
Reynders, John V. W.
Rice, Calvin S.
Richards, R. H.
Rickard, Edgar
Riddell, Guy S.
Robertson, F. Y.
Robie, E. H.
Rogers, Allen H.
Rolle, Sidney
Ronaghan, A. J.
Rutherford, Forest
Ryan, John D.

S
Saunders, W. L.
Savage, Edward
Schuster, Edward
Smith, E. A. Cappelen
Smith, H. DeWitt
Smith, W. Hinckle
Spurr, J. E.
Straus, R. W.
Sully, John M.
Sussman, Otto
Skinner, E. N.

T
Taylor, S. A.
Thompson, A. T.
Tuttle, Arthur S.

U
Ulrich, C. T.

W
Wallace, Wm., Jr.
Ward, A. T.
Wardner, H. S.
Weld, C. M.
Wemple, H. R.
Wilson, Carroll A.
Winant, Clinton D.
Wraith, William

Y
Yeatman, Pope

Z
Zimmer, B. N.

Jackling spent $190,000,000, saved the government $50,000,000, and earned for himself the Distinguished Service Medal. Mr. Baruch thought it was a good thing occasionally to gather together and say to his face a few kind things about a man.

Louis S. Cates, general manager and vice-president of the Utah Copper Co., who is regarded as the ranking man in the big Jackling organization, said he was proud to say a word about "our chief." He sketched the growth and development of Utah Copper by means of some comparative figures. The first concentrator at Copperton, near Bingham, had a capacity in 1905 of 300 tons per day; the two plants at Garfield now can handle 45,000 tons in twenty-four hours. The extraction has been improved from 60 to 90 per cent; the tenor or the ore has fallen from 2 per cent copper to less than 1 per cent. The cost of production has been reduced from 11.6c. per pound of copper to less than 7c. in spite of an increase of 56 per cent in the wage scale, 70 per cent in the average cost of supplies, and 664 per cent in combined local, state, and federal taxes.

The original investment was less than $10,000,000 and dividends to date have totaled $145,000,000. Mr. Cates' statistical data then broadened to include the other three porphyries in the Jackling group, showing the immensity of the figures for pounds of copper produced and tons of ore and waste mined and milled.

He pointed out among the dominant traits of the chief his talent of prevision, his ability for broad conception, his power to create, his capacity to bring his plans to fruition, and his faculty for inspiring his staff to loyal co-operation. Speaking in behalf of the others as well as of himself, he concluded an appropriate and much appreciated address with these words, "May we long have the privilege of serving under such leadership."

C. F. Kelley, president of Anaconda Copper Mining Co., emphasized the fitness of the award. It was richly deserved, he thought. He traced briefly the development of civilization: the stone age, the bronze age, and the iron age. Copper has been an important contributor to the economic, scientific and political growth of civilization, from the day man first learned to make a fire until the present. Because of its characteristic physical properties, it fills a unique place in the modern world. Mr. Kelley credited the medalist with being the pioneer in a development that is recognized as a distinctive contribution to the art of producing copper. That which has become common knowledge too frequently is regarded as commonplace; the world is prone to minimize the importance of the contribution of the individual who first showed how a thing can be done.

Mr. Kelley sought to avoid the fulsome praise that would be embarrassing to the medalist. Unquestioned honesty, integrity beyond impeachment, unusual breadth of vision, fair-mindedness, faith in the soundness of his own conviction and a genius for administration —these were some of the attributes mentioned by Mr. Kelley.

In accepting the medal from Mr. Crane, the recipient declared that he felt that he was in a sense acting in the capacity of a trustee for his associates and collaborators, on whom the reward reflects credit as well as on himself. The profitable exploitation of low-grade ores was a composite result contributed to by many men and many minds. The essence of its success was the handling of immense tonnages.

Perhaps the keynote of the occasion was directness, sincerity, and simplicity, all characteristics of the medalist. Each of the speeches rang with genuineness. Reference seldom was made to Colonel Jackling—he is a colonel, but does not fancy the title—or to Mr. Jackling. Mr. Hayden spoke of "Jack"; Mr. Cates, of "the chief"; Mr. Kelley and Mr. Baruch used just plain "Jackling" (it sounded like "Jacklin") more often than anything else. The man who first successfully exploited low-grade copper mines does not put much stock in titles and trimmings. He is distinctly not of the effete East.

Awards made heretofore by the society include: Herbert Hoover and Lou Hoover, "Contributions to the Literature of Mining"; Robert Hallowell Richards, "Advancement in the Art of Ore Dressing"; James Furman Kemp, "Advancement of the Science of Economic Geology"; Edward Payson Mathewson, "Art of Non-ferrous Metallurgy"; Pope Yeatman, "Administration of Mines"; Charles Eugene Schneider, "Metallurgy of Iron and Steel"; E. A. Cappelen Smith, "Art of Hydrometallurgy"; Charles Warren Gooodale, "Increasing the Safety of Men in Mining and Metallurgical Operations"; Robert Peele, "Literature of Mining"; and Frederick Gardner Cottrell, "Development of a Method of Electrical Precipitation of Solid and Liquid Particles from Smelter Smoke, and in Recognition of His Public Spirit in Making a Gift of the Proceeds of His Invention for the Support of Scientific Research."

The consensus of opinion seems to be that none of them is more richly deserved than that made to Daniel Cowan Jackling for "Development of Low-Grade Mines."

Rickard to Lecture at Columbia

T. A. Rickard has accepted an invitation to give two lectures on "The History of Mining" at the School of Mines, Columbia University, on Nov. 16 and Nov. 18 respectively. The lectures will be held in Schermerhorn Hall and will start at 4:30 p.m. Mr. Rickard, who has been abroad the greater part of the year, is expected to arrive in New York on Nov. 9.

Sullivan Mine and Mill Described

Feature of Canadian-American Meeting—Technical Session Held at Cranbrook, in British Columbia

By George J. Young
Associate Editor

THE WEEK-END concluding the joint meeting of the Canadian and American Institutes at Spokane, held on Oct. 13 and 14, 1926, was spent at Cranbrook and later at Kimberley, B. C. Special cars were provided by the Spokane International Railway. An excellent dinner was tendered in honor of the visitors at Cranbrook by the Cranbrook Board of Trade. At the conclusion of the general addresses the technical meeting was held, Charles A. Banks, chairman of the B. C. Division, C. I. M. & M., presiding.

Two papers were presented, both by staff members of the Consolidated Mining & Smelting Co. M. M. O'Brien discussed mining methods in use at the Sullivan mine. The history of the discovery of the Sullivan mine was briefly presented. The discovery of the North Star mine first attracted attention, and when Pat Sullivan and John Chaver, both of whom had gone into the region in May, 1922, found that all available ground was taken up in the vicinity of the North Star, they determined to continue their search and crossed Mark Creek and prospected the opposite hill. The outcrop of the Sullivan mine was found almost opposite the North Star outcrop. The property was bonded several times; in 1896 by A. Hansen of Leadville; later by Colonel Redpath, Judge Turner, and their associates, who formed the Sullivan Group Mining Co. In 1900 development began, and during the next few years lead-ore shipments were made. A smelter was constructed in 1903, but difficulties caused a shutdown in 1907. Reorganization followed under the name of the Fort Steele Mining & Smelting Co., which was controlled by the Federal Mining & Smelting Co. Late in 1909 the Consolidated took a lease and bond upon the property and installed sorting equipment. Promising results were obtained, and after a diamond-drill exploration campaign, the Consolidated took the property at the end of 1910. The metallurgy of the complex ores was systematically attacked and production was increased. Finally the application of selective flotation was successfully worked out and the mine became workable over large areas.

There are two principal ore zones, the north and the south, the intervening portion, 800 ft. in length, being occupied by a body of pyrite. Orebodies form a series of lenses of irregular shape. The ore formation is in quartzites, which fortunately are hard and firm. The strike is approximately north and south and the dip, which varies, is to the east. Folds and overturns complicate the structure and more or less influence the mining. Some trouble has been caused by heating of broken ore and sulphide material, and as a consequence no large amounts of broken ore are allowed to accumulate.

Two adits gave access to the workings on the 4,600 and the 3,900 levels. The latter is a 10x12-ft. drift extended in the quartzites on the footwall to the lode at the north orebody. It is 11,500 ft. in length. Concrete posts and steel I-beams are used for its support, a few timbered sections being now replaced with concrete. Track gage is 36 in.,

and 70-lb. rails are used. Development consists of footwall crosscuts and parallel footwall drifts. Raises and ore transfers are extended up on a 65-deg. inclination and flattened at the footwall to an angle just sufficient for ore flow. They are extended to the hanging wall. A main raise for supplies, air lines and power cables, and man hoist is provided.

Stoping is started at the top of a raise and the ore is broken by drills mounted upon tripods. The top of the raise is funneled out and a crater developed. Support is effected by pillars of ore. Branches or fingers are extended from primary raises. Width of stopes is determined by the nature of the hanging wall.

Mr. O'Brien said: "Stoping operations are arranged with three ideas in mind: safety, recovery of all of the ore, and costs. It is therefore necessary to reach the hanging wall before deciding on the area to be exposed; to mine along the hanging wall first so that no ore will be left on a high back, and to locate pillars carefully and of sufficient size so that they can be drawn later.

"There has been about 15 per cent of the vein left as pillars in present workings. As the mined area and depth increase, the support of the cover will necessitate a greater proportion of pillar area. It may be necessary to leave about 25 per cent of the vein as pillars in the deeper workings."

Mr. O'Brien gave many details of the underground and surface equipment. He said that about nine tons of ore is produced per man underground. Three classes of ore, iron ore, crude lead ore, and zinc-lead ore or mill feed are produced. Since operations were started 4,800,000 tons of ore represent stope production and 170,000 tons development production. Annually 1,100,000 tons of ore is mined, from which is recovered 100,000 tons of lead, 55,000 tons of zinc, and 4,000,000 oz. of silver. Narrow workings in the Sullivan now total 16 miles.

H. R. Banks, assistant superintendent of the Sullivan concentrator, discussed in considerable detail the characteristics of the mill, which is a short distance from Kimberley. Interesting points are as follows: Ore from the coarse-crushing plant at the mine averages 60 per cent plus 1 in. This is reduced by rolls in series to 6.5 per cent plus ½ in. 46 per cent plus ¼ in. and 54 per cent minus ¼ in. Steam directed on the ore stream is effective in allaying dust. Primary ball mills receive the product of the fine ore bins and grind at a pulp density of 70 per cent solids and discharge at 4 per cent plus 20 mesh, 48 per cent plus 150 mesh, and 42 per cent minus 200 mesh. Classifier overflow, 40 per cent solids, is 7 per cent plus 150 mesh, 15 per cent plus 200, and 85 per cent minus 200 mesh. Secondary ball mills receive the sands at 80 per cent solids from primary and secondary rake classifiers, the sand load of the secondary classifiers being kept at about 20,000 tons, which high circulating load appears to be necessary to get the maximum "grind." Overflow from secondary classifiers is passed through two bowl classifiers and thence into a surge tank. Sands from bowl classifiers are ground in a third group of ball mills.

Flotation is effected in M. S. machines of the spitzkasten type with cast-iron spitz bottom, variable spigot control, and weir overflow water-level control. They are of local design. A rougher-lead and a rougher-zinc product are made, and each is cleaned, giving high-grade products. Mr. Banks said: "The reagents used to accomplish the lead-rougher float consist of 1/10 lb. sodium cyanide, 3⅛ lb. soda ash, and about 0.2 lb. of a mixture of water-gas tar, coal-tar creosote, and cresylic acid. Soda ash and cyanide are added to the grinding circuit. The greater portion of the oil is added to the grinding circuit and to the surge tanks ahead of the flotation machines. The remainder of the oil is added down the machines and an additional 0.06 lb. of cresylic acid is added on the middling cells of the lead roughers."

Pulp from the lead roughers is heated in distributors by live steam to 30 deg. C. and 0.7 lb. per ton copper sulphate and 0.1 lb. per ton sodium bichromate are added to the distributors as well as additional oil when necessary. The last three cells of the zinc roughers are provided with sub-aëration impellers and air at 4 lb. pressure to create a more intensified flotation condition. Zinc middlings are re-treated in a separate section of the mill.

The use of Diamond-Stiles Genter vacuum thickeners for removing excess water in the flotation feed is of special interest as well as the elevating of the pulp by sand pumps, of which sixteen 6-in. and thirty-two 4-in. are in operation. Thickeners and disk filters are used for dewatering the final concentrates which are shipped to Trail.

It is difficult to do justice to the two excellent papers in the limits of this article or to mention many novel details given in the milling story.

On Saturday the party proceeded by automobile to the Sullivan mine, where all were togged out in overalls, rubber boots, caps, and lamps. Every detail of the under-ground trip was provided for, but the management was not responsible for the drizzling rain. In due course some 140 visitors climbed onto the man cars and were hauled by trolley locomotive into the mine workings on the 3,900 level. A journey was then taken through the stopes and raises. The operation of a scraper and accessory hoist used to drag ore to chute raises where footwall slopes are insufficient was shown. The stopes are impressive—huge open chambers towering upward to the hanging wall and rimmed about by piles of broken ore. Paths at the upper edges of the ore pile enabled the visitors to reach the drilling points and to pass over the hogbacks separating the craters. A flood light gave an excellent idea of the wide open spaces. Descending through another tier of stopes the party, after delaying to inspect a mucking machine employed in development work, finally reached the main level.

The Sullivan mine is an orderly place. It is clean. Development openings are of generous size. The orebodies are huge. Hand shoveling has been reduced to a minimum by the use of massive scraper equipment and mucking machines. Undoubtedly the ore is mined very cheaply. It is transported in 80-cu.ft. Granby side-dump cars, hauled by 6- and 12-ton trolley-type locomotives.

A generous lunch was served the visitors at the company's quarters, W. M. Archibald, manager of mines, presiding. After this interlude the party visited the flotation mill, and under the leadership of numerous staff men acquainted themselves with the details of operation. This milling plant, the result of intensive study of a complex-ore problem and the visiting of numerous plants, is one of the noteworthy achievements in metallurgical practice. Its success stimulated the working of other complex ores and it now stands as an example of good metallurgical engineering and painstaking work on the part of general manager, S. G. Blaylock, and his staff of capable associates.

A banquet necessarily followed, and provided the jollity of the occasion. Charles W. Banks, of Vancouver, was toastmaster, and he marshalled a battery of fourteen serious speakers through their stunts, and then turned loose a group of less serious entertainers. It was the end of a perfect day.

The Sullivan Concentrator, Chapman Comp, B. C.

People You Should Know About

D. B. Hanna has been elected president of the Kirkland Lake Gold Mines of Kirkland Lake, northern Ontario.

Henry Krumb, consulting engineer for the Magma Copper Co., is visiting the company's properties in Arizona.

Clinton J. Hanson, Butte mining engineer, has accepted a position with the Premier Paymaster Co. at South Porcupine, Ontario.

J. H. Lewis, formerly with the Braden Copper Co., is sailing soon on an extensive trip to the mining districts of South America.

R. R. Ramsden, late of the Guanajuato Reduction & Mines Co., has gone to Zacatecas to become foreman of the Veta Grande mill.

A. Ramsden, formerly with the Guanajuato Consolidated Mining & Milling Co., is with the Peñoles company at its Natividad plant, Oaxaca, Mexico.

Robert Vaughan, for the past few years manager of the Pasadena-El Monte Gold Mines Corporation, will soon leave that property to make a visit to Canada.

John Martin has been appointed to fill the vacancy on the Transvaal Chamber of Mines Executive Committee caused by the resignation of **Sir Evelyn Wallers, K. B. E.**

George E. Farish, of 25 Broad St., New York City, has returned to New York after a six months' absence on professional business in Ontario, California, and Colorado.

L. H. Freedman has resigned as geologist for the Marland Oil Co., of Texas, and has left Houston for Dallas to take charge of the geological and land department of the Goodman Drilling Co.

George T. Hansen, president of the Utah Southern Oil Co., has returned to Salt Lake from a tour of the Amarillo field with **W. G. Skelly** and a delegation of New York bankers and newspaper men.

F. H. Moffit, of the Alaskan Branch of the U. S. Gelogical Survey, is investigating mining conditions in some of the mining districts contiguous to the Alaska Railroad and in the Chitina Valley.

R. J. Meachin, of Rivermines, Mo., has succeeded **O. M. Cozzens** in charge of operations of the New York Zinc Co., at Edwards, N. Y. The property was recently acquired by the St. Joseph Lead Co.

W. H. Woods, for some time with the Huronian Belt Co., Haileybury, Ontario, has left that company to take charge of the exploration work on the holdings of Don Rouyn Gold Mines, Ltd., at Rouyn, Quebec.

H. N. Moffatt, Minister of Mines in Southern Rhodesia, a grandson of the famous Dr. Robert Moffatt, was recently operated on in London for appendicitis. He is reported to be progressing favorably.

B. B. Boatright, R. O. Armstrong, and **Miss S. E. Husky,** of the Casper office, of the Conservation Branch of the U. S. Geological Survey, and **H. J. Lowe,** supervisor of oil and gas operations, Muskogee, Okla., have resigned.

J. Houston, consulting engineer, has returned from a visit to the northern Manitoba mining area, and will direct an electrical survey and diamond-drilling campaign on the Duprat property in the Rouyn mining area of Quebec.

J. H. Hedges, mining engineer attached to the staff of the U. S. Bureau of Mines, has returned to Washington after extended conferences with land owners in western Texas. He found owners of property in the areas thought to be favorable to the occurrence of potash to be unwilling to sign a contract such as is provided by the recent law authorizing potash explorations.

J. H. Hedges

Gordon Southgate, inspector of claims, of the Department of Mines and Industries, Pretoria, South Africa, recently returned from a holiday on the Natal Coast. He left Pretoria on Sept. 22 with the Mining Commissioner on a visit to the platinum fields in the Potgietersrust district, Northern Transvaal.

Feodore F. Foss, assistant to the president of the Wheeling Steel Corporation, has returned to the United States after a six months' trip in Western Europe, where he studied for his corporation the iron and steel industries of France, Belgium, Luxemburg, Germany, Czecho-Slovakia, and England.

T. A. Read and **Arthur Carrol,** metallurgist and mine superintendent, respectively, for Broken Hill South Mining Co., of Australia, were recent visitors at the Sullivan mine, at Kimberley, B. C. Messrs. Read and Carrol have been making a tour of the mines and metallurgical plants of South Africa, the United States of America, and Canada. They will leave Vancouver for Australia shortly.

Dr. William M. Guertler, a German metallurgist, recently conducted a series of three public lectures on steel problems at the Carnegie Institute of Technology in Pittsburgh. He is director of the Metall-Institut der Technischen Hochschule, in Berlin. Dr. Guertler's subjects were, "On the Corrosion Resistance of Steels," "New Contribution to the Constitution of the Nickel Steels," and "Systematic Procedure in Establishing the Limits of the Utilization of New Metal Combinations in Technical Practice." A report of his recent lecture to the New York Section of the A.I.M.E. will appear in next week's issue.

E. C. Saint-Smith, one of the staff of the Geological Survey of Queensland, Australia, has been given an important professional appointment in the East with a concern interested in tin mining having its headquarters in Melbourne, Victoria. He goes first to Burma, and afterward to several other parts of the East. Mr. Saint-Smith, who has a special knowledge of tin mining in Australia, has been for a number of years employed as a geologist by the Queensland Mines Department, and in this capacity has made many examinations, and furnished valuable reports, on mining fields and properties throughout that northern state of the Commonwealth. These reports included several on the Mount Isa silver-lead field. Soon after the opening of that field, Mr. Saint-Smith was "loaned" by the Queensland Government to the Mount Isa Mines, Ltd., and, as mine superintendent, supervised in its initiatory stage the development campaign being carried out by that corporation. A biographical sketch of Mr. Saint-Smith, with photo, appeared in the *Engineering and Mining Journal* of March 7, 1925.

Obituary

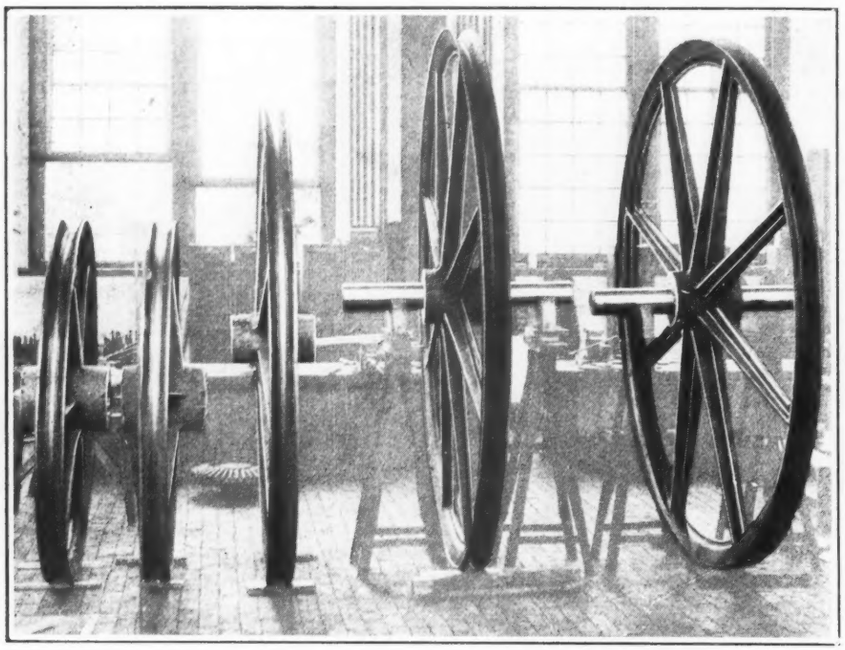
John L. Weber, seventy, pioneer Utah mining man, died on Oct. 17 in Salt Lake City. He was actively affiliated in the development of the mining resources at Park City.

Colonel H. H. Bottomley, for many years Inspector of Mines in the Far East Rand district, died on Sept. 20. The cause of death was congestion of the lungs, hastened by miners' phthisis. Colonel Bottomley had only recently retired from his government post on reaching the age limit.

Cornelius Sheehan, who with **W. S. Wheeler** was interested in the Old Gunsite groups of mines south of Ajo, Ariz., died earlier in the year, according to advices just received from Mrs. Sheehan, his widow. Preparations are now being made to work the property by those who were interested with Mr. Sheehan.

Charles Boney, a Rand pioneer, died at Langlaagte, near Johannesburg, on Sept. 20. He was born at St. Bluizey Gate, Cornwall, and spent several years in Cumberland, before going to America, where he worked three years in the copper mines of Nevada. Arriving on the Rand in 1887, he worked nineteen years on the Robinson gold mine, for part of which time he was mine captain. Later he was mine captain on the Treasury and Spes Bona mines. He leaves a widow and six children, the eldest son being now mine captain on Langlaagte Estate.

New Machinery and Inventions



Rim, hub and spokes cast integral

The rims of these sheaves are machined. This not only assures a smooth path for the rope and accordingly reduces the wear upon it, but inasmuch as the finished groove is a true circle vibration of the cage is cut to the minimum.

Head Sheave's Weight Cut By Steel Casting

Heretofore the bicycle- or wrought-spoke sheave has been widely used on mine headframes and tipples. Although this type has given fairly satisfactory service there have been instances of the spokes working loose or breaking off. These have been particularly frequent where proper care has not been exercised in casting the rim and hub so as to avoid undue shrinkage stresses.

To meet the need for a stronger sheave the ordinary bicycle type has been built with rim and hub made of steel casting. On account of the unequal shrinkage of steel, however, and the excessive stresses set up thereby, it was found difficult to cast a bicycle type of steel sheave that would run true, as the rim had a tendency to warp out of shape. This difficulty could be only partially overcome by machining the rim, for although this trued up the groove, if the wheel was badly distorted to begin with, perfect balance could never be secured. This was particularly noticeable at high hoisting speeds, resulting in rapid rotation of the sheave.

All-steel cast sheaves as shown in the accompanying illustration and built by the Vulcan Iron Works, of Wilkes-Barre, Pa., seem to overcome most of these troubles. As may be seen these sheaves are cast integral in one piece. It is claimed by the manufacturer that these sheaves have adequate strength, proper balance and great durability, while they cost no more than those of the bicycle type. Inasmuch as steel casting is from four to seven times as strong as cast iron, rim and hub sections can be appreciably reduced without sacrifice of strength.

Inertia is decreased on account of the sheave being lighter. This reduces the wear and tear on the rope. The groove of the new wheel is, of course, machined, thus assuring that both sheave and rope will run true, avoiding vibration of both cage and headframe. This machined groove also forms a smooth path or bed for the rope, thereby reducing the friction and wear upon it.

New Type Blast-Furnace Blower Put in Operation

The air supply for the new furnace of the Mystic iron works at Everett, Mass., is furnished by the new type of General Electric blast furnace blower. Two 45,000-cu.ft. units have been installed as part of the furnace equipment, the units being duplicates, one to be permanently in service and the other to be reserved as a spare. This is the first opportunity General Electric has had of demonstrating its new blast furnace blower to the trade. The plant was placed in blast Sept. 27.

Each of the two blower units consists of a three-stage, water-jacketed blower with radial flow impellers capable of delivering any volume up to 45,000 cu.ft. of air at pressures up to 30 lb. The drivers are eight-stage, condensing, General Electric turbines with multiple valve control. Each turbine is equipped with the usual emergency and speed governors, the latter acting as a pre-emergency governor without shutting down the unit. In ordinary service, however, the blower is controlled by the new General Electric constant volume governor.

Diesel Engines Equipped for Quick Starting

Interest of the metal-mining industry in self-contained prime movers, such as internal combustion engines for standby service, is increasing. A new line of Diesel engines built in ratings of 480, 600 and 720 hp. has recently been announced by the Fairbanks-Morse Co., of Chicago, Ill. These engines will particularly lend themselves to standby or emergency service, on account of their simplicity in design. The manufacturers claim that the construction of these machines has been greatly simplified and that they require little attention during operation. They are two-cycle, single-acting machines using airless injection and embody the fundamental simplicity of the smaller engines of this type.

Being compact, yet accessible, these machines are built to stand the hardest service with the minimum of operating attention and they show also, according to the manufacturer, excellent fuel economy. A matter which is important in engines for this type of service is reliability. These machines, it is claimed, start and run so smoothly that there is little difficulty from this source.

Control is centered in a compact and accessible unit located at the center of the engine. A governor is mounted beside the injection and air starting mechanism, thus centralizing the complete control system.

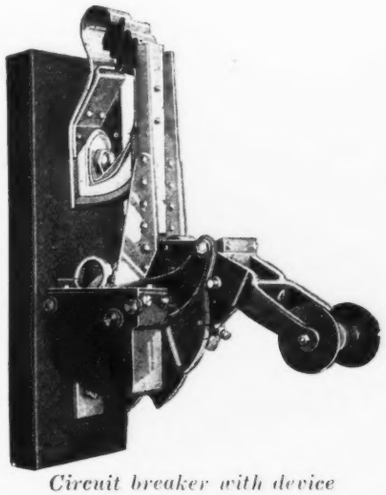
A large hand wheel is used in starting. When this is turned to starting position, air at about 250 lb. pressure is admitted to the cylinders in such sequence that the engine begins to turn over. The wheel is then revolved to the running position and firing commences.

Speed control is accomplished by a conveniently located governor. A simple fuel pump is required for each cylinder and since high pressure air is not used for fuel injection, the mechanism required for starting is free from complications. The whole starting operation takes only a few seconds.

Pressure lubrication is employed. A rotary pump draws oil from a storage tank and forces it first through a duplex strainer and then through a cooler into the header in the lower base of the engine. From here the oil is distributed by branch lines to all bearings.

New Direct-Acting Time-Limit Device for Circuit Breakers

An attachment for standard-type circuit breakers which will prevent the latter from opening until an abnormal current has existed for an unusual length of time, or where there is an overload of such high value as to be equivalent to a short-circuit, has been announced by the Roller-Smith Co., 233 Broadway, New York, N. Y. This direct-acting, time-limit attachment is designed especially for use where circuit breakers are used for motor protection because the starting current on the majority of motors is considerably in excess of the running current, thus necessitating the use of a circuit breaker which will not open during the normal starting period.



Circuit breaker with device

The attachment is easily secured to the outside housing of the outside poles on multiple-pole breakers by means of two bolts.

This attachment consists of paddles which are mounted in a cast, quadrant-shaped chamber filled with oil. The operation of the device is as follows: When the circuit in the overload coil of the breaker increases to the point where the magnetic pull of the core is sufficiently strong to attract the overload armature this armature is attracted upward in exactly the same fashion as on a regular breaker. The upward motion, however, is retarded by the suction which exists between the paddles. Because of the accurately ground surfaces of these two paddles and the fact that they are submerged in oil, a comparatively strong pull must be exerted to separate them. If the pull of the overload core pin continues long enough or reaches a high point, due to a very heavy overload or short, the seal between the two paddles is broken and the armature rises, instantly driving the handle and lever over and thus tripping the breaker in the conventional manner.

Blowers for Mine Ventilation

In a recent bulletin the Coppus Engineering Co., Worcester, Mass., describes its Vano and Ventair blowers and exhausters, especially designed for mine ventilation. The first of these, the Vano, is a medium-pressure propeller fan delivering comparatively large volumes of air and with an efficiency as high as 80 per cent for both high and low pressure. The air enters and leaves in the same direction — parallel to the axis, with unrestricted passage through the machine. The Vano is installed in a duct like a piece of pipe or a valve. Power consumption is constant at constant speed, irrespective of length or size of duct. The ring carrying the air turbine buckets is shrunk around the periphery of the aluminum fan. This single unit is carried by a heavy shaft supported by two liberally over-sized deep-groove ball bearings.

The Ventair is a high-pressure centrifugal blower with a fan having non-overload characteristics. A ring carrying the turbine buckets is shrunk on the back of the aluminum fan. This leads to simple unit design, one heavy shaft being supported by two large ball bearings. Advantages claimed for both of these machines are low air consumption, high efficiency, light weight (portable), and a highly desirable compactness of design.

Copper Alloy Arc Weld Bond Is Easily Applied

A new welded bond for application to the rail base by the copper alloy metallic arc process, which includes a hook on the terminal for holding in place while the welding process is taking place, has been placed on the market by the Ohio Brass Company. It is known as Type AW-12.

This bond is provided with malleable cast iron terminals which catch and retain the deposited metal from the arc, and also act as mechanical protection for the finished weld.

The hook is cast as a part of the terminal and is so shaped that the bonding crew can attach it to the rail with a tap of a hammer and thus firmly hold it in place while welding.

The size and shape of the terminals, which project from the rail, provide ample working space for the electrode. After striking the arc on the rail, the operator may clearly see that his arc is drawn to the proper length, and that a thorough arc-fusion is made of the rail surface, the terminals, the exposed surface of the copper strands and the deposited metal. These features and the use of copper metallic arc process, with copper alloy as the electrode, contribute in effecting a complete homogeneous fusion to the rail, bond, and deposited metal. The result is a strong, compact weld.

Cable becomes part of weld

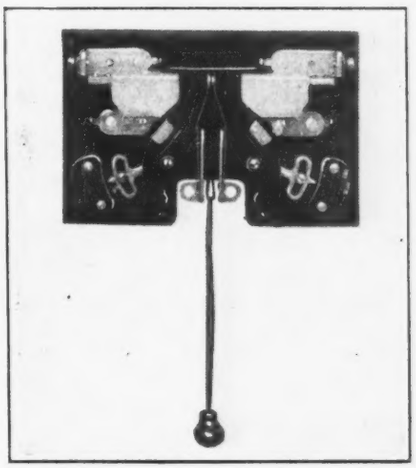
Every wire in the cable strand extends through the terminal and becomes part of the weld, providing a copper path from weld to weld, insuring maximum conductivity.

This bond has a soft copper sleeve between the bond terminal and the strands which protects the strands where they enter the terminal. It is said that this prevents breaking of the strands from bending and vibration.

Complete Motor Protection

Complete protection is provided for single-, two-, or three-phase motors by having two heating elements in each two phases; protection for motors on direct-current circuits is obtained by having the heating elements connected on each side of the line. This has been accomplished by the General Electric Co., Schenectady, N. Y., by redesigning the TC-121 temperature overload relay.

This improved relay is known as the form C, or TC-121-C. Improvements in design allow the use of renewable heating elements, prevent the bending of thermostatic strips by operators and include a better mechanical construction.



Protects motors from overloads

The relay is conveniently reset by means of a cord and button suspended from the bottom. Its heating elements are renewable.

Catalogs

Power Transmission — A 300-page catalog of power-transmitting equipment has been issued by the Dodge Manufacturing Corporation, of Mishiwaka, Ind. The book is indexed and well illustrated and includes price lists.

Doors — Cornell Iron Works, 71 Marion St., Long Island City, N. Y., has issued a 32-page catalog on steel rolling shutters and doors.

Electric Welding—The second number of the "Operator's Stabilizer," issued by the Lincoln Electric Co., Cleveland, Ohio, has been received. This is not a "house organ," but is a leaflet containing suggestions and hints for welding operators. The company's purpose in publishing it is to make better operators and thereby spread the use of electric welding.

Circuit Breakers — "Experience Is Master" is the title of a handsomely bound and printed book of 77 pages describing the growth and the present status and personnel of the Cutter Company, of Philadelphia.

Grinding—The Centripact Machinery Co., 2440 East 56th St., Los Angeles, has issued a catalog describing Agnew centripact machinery including a mill of novel design, a feeder, a screen, and amalgamator.

Mine Supply Houses—The *Engineering and Mining Journal* has compiled a list of the principal mine-supply houses and manufacturers' sales agents of the United States and Canada. Those in the United States are classified by states; the list is 14 pages long, and will be sent upon request to anyone addressing the publication.

Meters—Bulletin 43 of the Connersville Blower Co., Connersville, Ind., covers certain meters for special service made by the company. These are the tandem meter, the demand recorder, the reversing P. V. T. T. recording gage, and the long-distance recorder.

The Market Report

Zinc, Lead, and Tin in Good Demand—Copper Neglected

Price Concessions Tempt Buyers in Tin and Lead—Copper Also Lower—Silver Steadier Around 53c.

New York, Nov. 3, 1926—The Election Day holiday yesterday has interfered somewhat with the total volume of metal sales in the week ending today, but on the basis of a five-day week, sales have been very satisfactory except those of copper. Further concessions in the domestic market, bringing the price delivered to Eastern consumers below 14c., have not stimulated much business. A fine business has been done in zinc, however, at steady prices. Lead has declined further, with the drop in London below £30, but some producers report heavy sales; tin business has also been stimulated by lower prices, considerable short covering being reported by dealers. There is hope that metal buying will improve now that the election is passed.

Daily Prices of Metals

Oct. Nov.	Copper N. Y. net refinery	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
28	13.775	66.50	68.50	8.25	8.00	7.20@7.25
29	13.775	66.00	68.00	8.25	8.00	7.20@7.25
30	13.775	66.125	68.125	8.25	7.95@8.00	7.225–7.275
1	13.675	66.125	68.125	8.125	7.875	7.225–7.275
2	Holiday	.....	.....	.....	.....	.....
3	13.725	67.75	69.75	8.00	7.80@7.825	7.225–7.275
Av.	13.745	66.500	68.500	8.175	7.933	7.240

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

Oct. Nov.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
28	58 1/4	59 1/8	66 1/2	303 3/4	300	30 5/8	30 1/2	34 1/8	34
29	57 3/4	58 5/8	66 1/2	295 1/2	293 3/4	30 5/16	30 3/16	34 3/16	33 15/16
1	57 5/8	58 1/2	66 1/2	293 1/2	290 3/4	29 1/4	29 1/4	33 5/8	33 5/8
2	57 3/4	58 5/8	66 1/2	297 1/4	293 3/4	29 5/8	29 9/16	33 7/16	33 3/8
3	57 13/16	58 3/4	66 1/2	300	294 1/4	29 3/4	29 13/16	33 1/2	33 7/16

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

Oct.	Sterling Exchange "Checks"	Silver		Gold London	Nov.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
28	4 84 1/4	52 3/4	24 7/16	84s11 1/2d	1	4 84 1/8	53 3/8	24 15/16	84s11 1/2d
29	4 84 1/4	53	24 13/16	84s11 1/2d	2	Holiday	.....	24 15/16	84s11 1/2d
30	4 84 1/8	53 3/8	24 13/16	.....	3	4 84 1/8	52 3/4	24 9/16	84s11 1/2d

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-half cent premium.

Average Metal Prices for October, 1926

Copper:	
New York Electrolytic	13.862
London Standard Spot	58.304
London Electrolytic Spot	66.298
Lead:	
New York	8.402
St. Louis	8.130
London Spot	30.821
London Forward	30.702
Silver:	
New York	54.505
London	25.291
Sterling exchange	484.475
Zinc:	
St. Louis	7.296
London Spot	34.256
London Forward	34.146
Tin:	
99 per cent	68.225
Straits	70.245
London	312.548
Quicksilver	97.260
Antimony	13.943
Platinum:	
Refined	112.240
Crude	106.000
Aluminum, 98 per cent	27.000

Copper Below 14c., Delivered

On Thursday, Friday and Saturday domestic prices were well maintained at 14c., delivered in the East, and 14⅛c. in the Middle West, a very moderate amount of business being booked. On Monday, also, a little was sold at those levels, but some impatient holders cut their prices to attract consumers, and a good tonnage was sold at various levels down to 13¾c., delivered. Today, there seems not quite the anxiety to sell, and nothing as low as 13¾c. is reported, though there seems no particular reason for any stronger market just at this time, even though London standard has made fractional advances the last three days. No stampede for November copper is yet evident, and it would seem that consumers are finding their supplies lasting a little longer than they expected; certainly they can hardly be running on any more hand-to-mouth basis than they have for some months. The various sales during the week, which have amounted to only a small total tonnage, have been for scattered deliveries up to April, sellers making practically no difference in their quotations for the various months to come.

Among the consumers there is not quite the same optimistic feeling regarding the winter's business that obtained during the late summer and early fall. Still, they are all active and

are booking new business in good volume, chiefly for prompt shipment. Brass products are reported to have sold exceptionally well lately.

The foreign price has been maintained at 14.40c., c.i.f., ever since the export association began to function. Some grumbling has been expressed that it has not been revised downward, in view of the weakness in the domestic market, but it is evidently felt that this is temporary, and stabilization was the primary aim of the association. However, should domestic demand be active at markedly lower prices, the foreign price would no doubt be changed. Export sales are reported as fairly good.

Further Decline in Lead

Lead buying during the week ending today has been active, particularly in the Middle West. This was especially true before the American Smelting & Refining Co. reduced its official New York price from 8.25c. to 8.10c. on Monday, Nov. 1. At the same time the market has been by no means dull, either Monday or today. Very little cutting of the New York price has been reported, and on last Thursday and Friday 8c. was the bottom of the market in St. Louis. On several lots 8.025c. was realized. However, the price in London weakened on Thursday and Friday, and again on Monday, bringing the parity to a point where bullion lead threatened to enter the domestic market; and this was the principal reason for the cut made by the Smelting company. London has recovered some of the lost ground the last two days, and accordingly the cut late this afternoon of another $2 by the Smelting company, bringing the price to 8c., was a surprise to many in the trade. In some quarters it is interpreted as indicating that the Smelting company is not so optimistic as the other producers on the domestic situation at the moment. The view is held by many that buyers, particularly smaller users, have been waiting for an 8c. market, and that one of the periodical buying waves should start soon, if, indeed, it is not already under way. Buyers during the week have included all classes of consumers, with cable makers apparently more interested than some of the others. Several of the important producers find themselves with very little November lead for sale, but on the other hand another seller is prepared to take fairly large-sized orders for early shipment. Most of the buying has been for November and December, with little interest beyond the first of the year.

Zinc Steady Around 7¼c.

Galvanizers have bought zinc in excellent volume in the week ending today, and prices have fluctuated but little, the range being between 7.20 and 7.275c., St. Louis, net to producers. They are still complaining of an unsatisfactory market for galvanized goods, though there seems no difficulty in absorbing current zinc production. In fact, producers are getting short of November metal, and should there be a pronounced demand for prompt shipment in the current month, there might be some difficulty in meeting it. Many manufacturers are skating on rather thin ice in the way of zinc supplies. The demand has been fairly well divided between November and early December in the last few days, with sellers endeavoring to get a 2½-point premium for prompt shipment. New York prices continue 35c. per 100 lb. above St. Louis, equal to the freight differential. Brass Special commands but slight premium over Prime Western; perhaps 5 points. High-grade is unchanged at 9@9¼c., delivered at Eastern points.

Spot Tin Still Scarce

Spot Straits tin is in the hands of a single dealer in the domestic market, but prompt and early delivery can be had from boats at dock and due to arrive within a few days. Nevertheless, a good business has been done during the early part of the week ending today in November, December and January positions. Because of the tight position, the big drop in London on Oct. 29 was followed by only a small decline in the domestic market. November tin can be had at a discount of 1¾c. over the price for immediate delivery. Tin of 99 per cent grade cannot be had in the domestic market, and none has been offered since last Wednesday. In the absence of any actual business the quotations shown in the table on page 754 are entirely nominal and are based on a differential of 2c. per lb. compared with the prices for Straits. This is the average spread between the prices for 99 per cent and Straits for such deliveries as are available for both. The condition appears to be temporary, however, as 99 per cent can be bought at 64c. for immediate shipment from England on boats that should be unloaded before Nov. 20. The backwardation on Straits tin in London has increased by about £2 during the week. Statistics for October show shipments from the Straits amounting to 6,471 long tons, which is considerably higher than was anticipated. The world's visible supply increased by 462 long tons to 14,841 long tons, which compares with 15,770 long tons a year ago.

Silver Quiet and Firm

The silver market during the last week has been comparatively quiet, with somewhat more steadiness shown at present levels. Spot silver in London has ruled at a premium over forward of as much as ⅜d., due to good demand from India for shipment from London by this week's steamer. The market declined today on selling by China, and is without definite tendency at the close.

Mexican Dollars: Oct. 28th and 29th, 40¼c; 30th and Nov. 1st, 40⅛c.; 2d, holiday; 3d, 40¼c.

Francs Show Strength

The climb of the French franc was the feature of the foreign exchange market during the week ending today. Closing cable quotations on Tuesday, Nov. 2, were: francs, 3.19¾c.; lire, 4.225c.; and marks 23.79¾c. Canadian dollars command a premium of ⅛ per cent.

Lead Ore Lower—Zinc Blende Unchanged

Joplin, Mo., Oct. 30, 1926

Blende	
High	$52.40
Premium blende, basis 60 per cent zinc	$49.00@50.00
Prime Western, basis 60 per cent zinc	48.00
Fines and slimes, 60 per cent zinc	47.00@45.00
Average settling price, all zinc	47.83
Galena	
High	$106.90
Basis 80 per cent lead	100.00
Average settling price, all lead	104.98

Shipments for the week: Blende, 18,296; calamine, 48; lead, 3,438 tons. Value, all ores the week, $1,239,700.

Shipments for ten months: Blende, 703,182; calamine, 1,095; lead, 107,930 tons. Value, all ores ten months, $46,273,510.

At noon today buyers of lead announced a price $2.50 per ton lower than the price current the last two weeks and $10 less than the opening price of the month. Lead shipments still cover purchases made on $107.50 and $110 basis early this month. The price offers today are for future deliveries, and it is reported sellers are declining to accept the lower offering.

Steel and Pig Iron Firm

Pittsburgh, Nov. 2, 1926

Except for the rail-buying movement, the turnover in the steel market has continued to decrease, but only slightly. Consumption on the whole is decreasing a trifle, from seasonal influences. In the automobile trade there is a sharp decrease; on the other hand, requirements of the building trades hold up unusually well.

Steel production in the last week of October was about 5 per cent under the rate at the close of September, indicating a slight decrease for October as a whole, from the August-September rate. Some further decrease is expected.

These decreases make no unfavorable augury for the new year, the present prospect being that there will be a seasonal upturn soon. The year now closing makes a new tonnage record, and the general outlook is for 1927 to be substantially as good.

Steel prices are firm all along the line. Sheet prices as advanced a month ago are holding, with a fair volume of new business coming in and heavy shipments being made on old orders, except to the automobile trade.

Pig Iron—Demand continues light, but furnaces are in a strong position on account of the scarcity of coke. On actual transactions basic and foundry have advanced 50c. to $18.50 and $19 respectively, but furnaces have marked up asking prices $1, on account of coke conditions, making the market quotable as follows: Bessemer, $19.50@$20.50; basic, $18.50@$19.50; foundry, $19@$20, f.o.b. Valley furnaces.

Connellsville Coke—Effective yesterday, independents advanced wages about 40 per cent, to the Frick scale. This raises the settlement price on contracts with furnaces, with run to the end of the year, about 75c. Spot furnace, $5@$5.50; spot foundry, $5.50@$6.

Other Metals

Quotations cover large wholesale lots, f.o.b. New York, unless otherwise specified. London prices are according to latest mail advices.

Aluminum—Per. lb., 98 and 99 per cent, 27c. London, 98 per cent, £107 per long ton for domestic metal.

Antimony—Per lb., duty paid: Chinese brands, 14¼@13¾c.; December, 13c. Cookson's "C" grade, spot 17½c. Market dull with little consuming demand in evidence.

Chinese needle, lump, 10c. Standard powdered needle, 200 mesh, 12c. White oxide, Chinese, 99 per cent Sb_2O_3, 14½c. Nominal.

Bismuth—Per lb., in ton lots, $2.70@$2.75. London, 10s.

Cadmium—Per lb., 60c. London, 1s. 10½d.@1s. 11d. for American metal; 1s. 9d. for Australian metal.

Cobalt—F.o.b. Canadian works, per lb., shot, 96@98 per cent, $2.50@$2.60. Black oxide, 70 per cent, $2.10. London, 10s. for metal; 8s. for black oxide; 8s. 10d. for gray.

[1]**Germanium Oxide**—Per gm. in 25 to 50 gm. lots, $6.

Iridium—Per oz., $120@$125 for 98@99 per cent sponge and powder. London, £32½ in iridio-platinum; £18@£22 nominal for sponge and powder.

[1]**Lithium**—Per lb., 95@96 per cent grade in 1 to 5 lb. lots, $65.

Magnesium—Per lb., in ton lots, ingot, 80@90c. depending on quality; best 99.8 per cent. Market firm. London, 3s. 9d.@4s. 3d. for 99 per cent ingots or sticks.

[1]**Molybdenum**—Per kg., 99 per cent, $25; C. P. metal, $80.

Monel Metal—Base price for shot, 32c. per pound.

Nickel — Per lb., ingot, 35c.; shot, 36c.; electrolytic, 39c. (99.75 per cent grade). London, £170@£175 per long ton according to quantity.

Osmium—Per oz., $60@$65; London, £16@£19.

Palladium—Per oz., $68@$70. Pure metal as a constituent of crude platinum, $55@$60 per oz. London, £11@£13, nominal.

Platinum — Official price on refined metal $112 per oz. Open market cash sales of large lots at $107. Pure metal as a constituent of crude platinum, $106.

London, £23 per oz. for refined, and £20½ for crude and scrap.

Quicksilver—Per 75-lb. flask, $98@$99. San Francisco wires $97.33. London, £16½.

Radium—$70 per mg. radium content.

Rhodium—Per oz., $65@$75; London, £14@£17. Nominal.

Ruthenium—Per oz., $50@$60, nominal. London, £12@£15.

[1]**Selenium** — Black, powdered, amorphous, 99.5 per cent pure, $2 per lb. in ton lots. London reports good demand at 7s. 6d.

Tantalum — Per lb., $36. Nominal only, as only seller has none to offer in open market.

Tellurium—Per lb., $2.

[1]**Thallium Metal**—Ingot, 99 per cent pure, $10 per lb. in 25-lb. lots.

Tungsten Powder—Per lb., 97 to 98 per cent pure, $1.05.

[1]**Zirconium Metal**—Per lb., 98 per cent grade, $30 in 5 to 10 lb. lots.

[1]Price furnished by Foote Mineral Co., Philadelphia.

Metallic Ores

Chrome Ore—Per net ton, f.o.b. eastern shipping points, $21@$24 for 45 to 50 per cent Cr_2O_3 ore. Prices firm and demand good.

Iron Ore—Lake Superior ores, per long ton, lower Lake ports, established season prices:

Mesabi, non-bessemer, 51½ per cent iron, $4.25. Old Range, $4.40.

Mesabi, bessemer, 51½ per cent iron, $4.40. Old Range bessemer, 51½ per cent, $4.55.

High-phosphorus foundry, over 0.18 per cent P, $4.15.

Eastern ores, cents per unit, delivered at furnaces: Foundry and basic, 53 to 63 per cent, 9@10½c.

Foreign ores, f.o.b. cars Atlantic ports, cents per unit:

Swedish and Norwegian, low-phosphorus, 68 per cent, 10¼@10¾c.

Spanish low-phosphorus, 52@54 per cent, 10@11c.

Algerian, low-phosphorus, 9¼@9¾c.

Spanish foundry or basic, 50@54 per cent, 8¾@9¼c.

Swedish foundry or basic, 66@68 per cent, 9@9½c.

Manganese Ore—Per long ton unit of Mn, c.i.f. North Atlantic ports, minimum 47 per cent Mn, 28@30c. Caucasian (washed), 53@55 per cent, 32c., nominal. Production high and takings comparatively small.

[1]Chemical grades, powdered, coarse or fine, 82@87 per cent MnO_2, Brazilian and Cuban, $70@$80 per ton in carloads.

Molybdenum Ore—Per lb. of MoS_2 for 85 per cent MoS_2 concentrates f.o.b. *Colorado*, 48@50c.

Tantalum Ore—Foreign, 50c. per lb. of Ta_2O_5 contained, c.i.f. New York, for 65 per cent Ta_2O_5 concentrate.

Tungsten Ore—Per unit of WO_3, N.Y.: Wolframite, $10.50@$10.75; Western scheelite, $11@$11.25.

Uranium Ore—Minimum 5 per cent U_3O_8 per pound of U_3O_8 contained, $5, f.o.b. Montrose, Colo.

Vanadium Ore—Containing 5 per cent V_2O_5, 25c. per lb. of V_2O_5, f.o.b. Montrose, Colo.

Foreign concentrate (lead vanadate) 12 to 18 per cent V_2O_5, 55@60c. per pound V_2O_5, duty paid, seaboard. Nominal.

Non-Metallic Minerals

Prices received for non-metallic minerals vary widely and depend upon the physical and chemical characteristics of the commodity. Hence the following quotations can serve only as a general guide to the prices obtained by producers and dealers in different parts of the United States for their own product. In the last analysis the value of a particular non-metallic mineral can be ascertained only by direct negotiation between buyer and seller.

[1]**Amblygonite**—8@9 per cent lithium oxide, $50@$60 per ton, f.o.b. mines.

Asbestos—F.o.b. *Quebec* mines, tax and bags included, per ton:

Crude No. 1, $525; crude No. 2, $300; spinning fibers, $190; magnesia and compressed sheet fibers, $125@$150; shingle stock, $70; paper stock, $40@$45; cement stock, $25; short fibers, $10@$17.50; floats, $15. Active market for all grades except paper, which is a trifle slack. Mine production close to full capacity.

No. 1 Rhodesian crude, $325; No. 2, $250 per ton, c.i.f. New York.

Barytes—F.o.b. mines, per ton, bags extra:

Georgia: Barytes ore, washed, $7.50. Demand steady.

Missouri: Water ground and floated, bleached, $23; $25 in less than car lots, f.o.b. works. Crude ore 93 per cent $BaSO_4$, not to exceed 1 per cent iron, $8, f.o.b. mines. Market firm for first-grade ore.

Bauxite—No. 1 chemical ore, over 60 per cent Al_2O_3, less than 5 per cent SiO_2, and less than 2 per cent Fe_2O_3, $8 per long ton, f.o.b. Georgia mines.

Foreign, per metric ton, c.i.f.: Dalmatian, low SiO_2, $5@$6.50; Istrian, $5.50@$7; French, red, $6@$7.50.

Borax—Carload lots, in bags, per lb.; crystals, 4¼c.; granulated or powdered, 4c.; f.o.b. plant, *Pennsylvania*.

[1]**Celestite**—90 per cent $SrSO_4$, finely powdered, $27 per ton in carload lots.

Chalk—Crude, in bulk, per ton c.i.f. New York, $4.75@$5.

China Clay (Kaolin)—F.o.b. *Virginia* mines, per ton; crude, lump, No. 1, $7; crude No. 2, $5.50; washed, $8; powdered and air-floated, $10@$20; ground, $7@$10.

Florida, pressed pottery, bulk, $13; ground, No. 1, $20; No. 2, $15. Sprayed mineral flour No. 1, $20; No. 2, $17.

1A grades, domestic, $16@$18, f.o.b. *Delaware* plants.

Imported English, f.o.b. American ports: Lumps, $13@$20; powdered, $45@$50.

Diatomite—Per short ton, f.o.b. plant: Kiln-fired brick, $65; kiln-fired aggregate, ¼ in., $45; insulating powder, $30; natural aggregate, ¼ in., $20; air-floated powder, $40. Over 85 per cent silica, 98 per cent through 200 mesh, $14.50@$16 depending on quantity.

Emery — F.o.b. *Pennsylvania* and *New York* in 350-lb. kegs, per lb. Greek Naxos, 6½c.; Turkish, 6½c.; Khasia, 5½c.; domestic, 3½@4c. Market good; domestic price higher.

Feldspar — F.o.b. mine or grinding plant:

North Carolina: No. 1 pottery grade, $6.50@$7 per long ton. Market better.

New Hampshire: Pottery grade, $8 per ton; soap grade, $8.50. Market heavy.

New York: Per ton, f.o.b. cars, No. 1 crude, $9. Market good.

Tennessee: No. 1 pottery, 140 mesh, $16 per ton; 200 mesh, $18. No. 1 enamel, 140 mesh, $14; 200 mesh, $16. Demand good.

Maine: Pottery grade, ground, $18 per ton. Market good.

Fluorspar—F.o.b. *Kentucky* and *Illinois* mines, per short ton:

Gravel, not less than 85 per cent CaF_2, and not over 5 per cent SiO_2, $18. Foundry lump, 85-5, $20. Ground, 95 to 98 per cent CaF_2, and not over 2½ per cent SiO_2, $32.50 in bulk; $36.50 in bags or barrels. Acid lump, 98-1, $30 in car lots. Doubt as to the trend of the steel business during next few months has made buying for forward delivery dull.

New Mexico: 85-5 gravel, $16.25; 85-5 lump, $16; 93-3 lump, $25; 96-3, ground 100 mesh, $35, bulk; $40 bags. Market strong.

Foreign spar, duty paid, $17.50, tidewater.

Fuller's Earth—Per ton, f.o.b. *Florida:* 16 to 30 mesh, $16.50; 30 to 60 mesh, $18; 60 to 100 mesh, $15; 100 mesh "up," $8; 200 mesh "up," $15. Market fair at unchanged prices.

Powdered, imported, duty paid, $24@$25 per ton.

Garnet — Domestic, per ton f.o.b. mines, $85.

Spanish grades, $60, c.i.f. port of entry.

Gilsonite—Per ton, carload lots, f.o.b. mines *Colorado:*

Jet asphaltum, $36; selects, $33; seconds (mine run), $25.50.

Graphite—F.o.b. *New York*, per lb.: Ceylon lump, 7@8½c.; chip, 5½@7½c.; dust, 3@6c.; Madagascar flake, 6½@7c. Market quiet.

Flake, 10@30c. according to grade; fine ground crystalline, 7@12c.; amorphous fine ground graphite, 4@8c. Crude amorphous graphite, $15@$35 per ton according to grade. Market unsettled.

Greensand—Per ton, f.o.b. cars, *New Jersey:* screened and bagged, best grade in carload lots, $30. Trade quiet.

Gypsum—Per ton f.o.b. mill, depending upon location: Crushed, $2.75@$3; ground, $4@$6; agricultural, $6@$12; calcined, $8@$12.

Ilmenite—Per long ton, concentrate or ore, 52 per cent TiO_2, f.o.b. Atlantic seaboard, $12@$15.

Iron Oxide (See Ocher)—Standard Spanish red, 2½@4c. per lb.; domestic earth, 2@4½c.

Kaolin—See China Clay.

[1]**Lepidolite**—20@$30 per ton for ordinary grades. Nominal.

Limestone — F.o.b. shipping points, depending on location: either lump or crushed, 90c.@$1.80 per ton.

Agricultural, 75c.@$2 for crushed or pulverized. Prices depend upon source, purity, and fineness.

Magnesite—Per short ton, f.o.b. *California* mines: Grade "A" calcined, 80 per cent through 200 mesh, $42.50; grade B, $38; dead burned, $33; crude, $14. F.o.b. eastern seaboard, calcined, $40. Market fair.

Mica—F.o.b. plant, per ton:

New Hampshire: Mine run, $380, clean shop scrap, $25; mine scrap, $22. White dry ground, 20 mesh, $30; 40 mesh, $40; 60 mesh, $55; 100 mesh, $70; 200 mesh, $85.

Madagascar, amber, dark, free from iron, per lb., f.o.b. *New York*, duty paid: special grade, $3.25; No. A 1, $2.75@$3; No. 1, $2.50; No. 2, $2.25@$2.50; No. 3, $1.25; No. 4, 65@70c.; No. 5, 40@45c. Grades depend on size of sheets. Good demand for Nos. 2 and 4.

[1]**Monazite**—Minimum 6 per cent ThO_2, $120 per ton.

Ocher—F.o.b. *Georgia* mines, per ton: $22.50@$25 in sacks; $25@$30 in barrels; washed and water floated, $25@$28; second grade, 99 per cent through 225 mesh, $19. Market good.

Phosphate—Per long ton, f.a.s. or f.o.b. mines:

Florida, pebble, f.a.s., for export: 76@77 per cent, $7; 75 per cent, $6.25; 74@75 per cent, $6; 70 per cent, $4.50; 68 per cent, $4.10; 66 per cent $4. Firm.

Florida, pebble domestic: 76@77 per cent, $6; 75 per cent, $5.25; 74@75 per cent, $5; 72 per cent, $4; 70 per cent, $3.50. Market dull.

Tennessee, ground, 95 per cent through 100 mesh, basis 65 per cent B.P.L. (tri-calcium phosphate), $8 per short ton, with unit differential of 20c. per ton.

Potash—A new "temporary" schedule was announced on Oct. 28 to apply on orders received up to Dec. 1 for Nov.-Dec. shipments, as follows:

	Bags	Bulk
Muriate of potash 80 @ 85 per cent, basis 80 per cent....	36.00	34.60
Sulphate of potash 90@95 per cent, basis 90 per cent....	46.85	45.45
Sulphate of potash-magnesia 48@53 per cent, basis 48 per cent	27.00	25.60
Manure salt 30 per cent....	21.55	18.55
Manure salt 20 per cent....	15.30	12.30
Kainit 14@16 per cent.....	12.40	9.40
Kainit 12.4 per cent.....	11.90	8.90

Two thousand pounds net weight, c.i.f. Atlantic and Gulf ports. German weights, tares and analyses.

Discounts: 5 per cent on minimum of 50 tons K_2O; 6 per cent on 100 tons; 7 per cent on 300 tons; 10 per cent on 500 tons. Prices guaranteed against sellers' decline until April 30, 1927.

Pumice Stone—In barrels, per lb., powdered, 2½@4c.; selected lumps, 5@7c.; lumps in bags, 3@5c.

Pyrites—Tharsis, per long ton unit of sulphur, c.i.f. U. S. ports; guaranteed 48 per cen sulphur, furnace size, 2½-in. diameter, 13¾c. Cinder from ore to remain property of buyers. Market unsettled.

[1]**Quartz Rock Crystals**—Colorless, clear and flawed, pieces ¼ to ½ lb. in weight, 40c. per lb. in ton lots. For optical purposes, double above prices.

Silica—Water ground and floated, per ton in bags f.o.b. Illinois: 400 mesh, $31; 350 mesh, $26; 250 mesh, $18.

Glass sand, f.o.b. producing plant, 75c.@$5 per ton; molding sand, 65c.@$2.50; blast sand, $1.35@$4.

[1]**Spodumene**—$20@$30 per ton, depending upon lithium content. Nominal.

Sulphur—$18 per ton for domestic, f.o.b. *Texas* mines; $24 for export, f.a.s. Atlantic ports. Good shipment against contracts. Open prices $1 higher than above. Prices unchanged.

Talc—Per ton, carload lots, f.o.b. works, containers included:

Vermont: 99 per cent through 200 mesh, extra white, $10.50@$11; 96 per cent through 200 mesh, medium white, $9@$10; packed in 50-lb. paper bags. Demand better.

New York: Double air-floated, 200 mesh, $13.75; 325 mesh, $14.75. Demand good.

Georgia: Powdered, gray, $7.50@$10; yellow, $9@$12; red, $11@$13; roofing, $7.50@$9. Market fair.

New Jersey: Soapstone, ground, $10@$12; market good.

Tripoli—Per short ton, burlap bags, paper liners, minimum carload 30 tons, f.o.b. *Missouri:* Once ground through 40 mesh: rose and cream colored, $14. Double ground through 110 mesh: rose and cream, $17. Air-floated through 200 mesh: rose and cream, $25; mill run, $15. Usual good fall business.

[1]**Zircon**—Freight allowed east of Mississippi River; 95 per cent, 3c. per lb., f.o.b. mines, in carload lots.

Mineral Products

Arsenious Oxide (white arsenic)—3¼c. per lb. London, £15¾@£16½ per long ton.

Calcium Molybdate—$1.20 per lb. of contained Mo, delivered.

Copper Sulphate—4.90c. per lb. for either large or small crystals.

Sodium Nitrate — Spot, crude $2.45 per 100 lb. ex vessel, Atlantic ports. Futures, $2.49@$2.58.

Sodium Sulphate (Salt Cake)—Per ton, bulk, f.o.b. works, $20@$22.

Zinc Oxide—Per lb. in bags, in car lots: Lead-free, 7¼c.; 10, 20 or 35 per cent leaded grades, 7¼c.; French, red seal, 10½c.

Ferro-Alloys

[1]**Ferrocerium**—Per lb., $5.50.

Ferrochrome—Per lb. of contained chromium, 60@70 per cent cromium, 4 to 6 per cent carbon, delivered on contracts, 11½c.; spot 12c. Market active.

Ferromanganese — Domestic, 78@82 per cent, $88@$90 per gross ton furnace, for prompt; futures $95@$100. Foreign product $95 to $100, seaboard. Nominal. Spiegeleisen, 19@21 per cent, $32@$34 f.o.b. furnace; 16@19 per cent, $31@$33.

Ferrophosphorus—Electrolytic, 18 per cent P, $91 per ton; 24 per cent, $122.50; f.o.b. *Alabama* and *Tennessee*.

Ferrosilicon—Per gross ton, f.o.b. works, freight allowed on carload lots east of Mississippi River: 50 per cent, $87.50 for spot, $85 on contract. 75 per cent, $150 for spot, $145 on contract. 14@16 per cent, $45. Active market.

Ferrotitanium—For 15 to 18 per cent material, $200 per ton, f.o.b. Niagara Falls, N. Y.

Ferrotungsten—$1@$1.05 per lb. of W contained f.o.b. works.

[1]**Ferro-uranium**—30 to 40 per cent U, $4.50 per lb. of U contained, f.o.b. works in 500-lb. lots.

Ferrovanadium—Per lb. of V contained, f.o.b. works, $3.40@$4, depending on grade; on contract $3.25@$3.75; spot $3.40@$4.

Metal Products

Rolled Copper — Sheet, 22¼c.; wire, 16c. per lb., f.o.b. mill.

Lead Sheets — Full rolled, 12c. per lb.; clipped, 12¼c.

Nickel Silver—29¼c. per lb. for 18 per cent nickel Grade A sheets.

Yellow (Muntz) Metal — Dimension sheets, 19¾c. per lb.; rods, 16¾c. per lb.

Zinc Sheets—11¾c. per lb., f.o.b. works.

Refractories

Chrome Brick—$45 per net ton, f.o.b. shipping point.

Fireclay Brick—First quality, $40@$43 per M., Ohio, Kentucky, Central Pennsylvania; second quality, $35@$40.

Magnesite Brick—9-in. straights, $65 per net ton, f.o.b. works.

Silica Brick—$42 per M., Pennsylvania and Ohio; $50@$52 Alabama and Illinois.

[1]**Zirkite**—Powdered, 80 per cent ZrO_2, 2½c. per lb. Brick, straights, 80c.@$1 each.

[1]Price furnished by Foote Mineral Co., Philadelphia.

Metal Statistics

Monthly Average Prices of Metals

Silver

	New York		London		Sterling Exchange	
	1925	1926	1925	1926	1925	1926
January	68.447	67.795	32.197	31.322	477.702	485.295
February	68.472	66.773	32.245	30.797	476.886	485.852
March	67.808	65.880	31.935	30.299	477.279	485.606
April	66.899	64.409	31.372	29.682	479.034	485.702
May	67.580	65.075	31.276	30.125	484.960	485.485
June	69.106	65.481	31.863	30.248	485.553	486.000
July	69.442	64.793	31.954	29.861	485.514	485.755
August	70.240	62.380	32.268	28.773	485.264	485.293
September	71.570	60.580	32.983	27.904	484.270	484.845
October	71.106	54.505	32.972	25.291	483.909	484.475
November	69.223	.....	32.155	.....	484.201	.....
December	68.889	.....	31.835	.....	484.538	.....
Year	69.065	.....	32.088	.....	482.426	.....

New York quotations cents per ounce troy, 999 fine. London, pence per ounce, sterling silver, 925 fine.

Copper

	New York Electrolytic		London Standard		London Electrolytic	
	1925	1926	1925	1926	1925	1926
January	14.709	13.822	66.065	59.013	70.607	65.325
February	14.463	13.999	64.714	59.669	69.525	66.375
March	14.004	13.859	62.892	58.603	67.739	65.489
April	13.252	13.706	60.575	57.200	64.194	64.600
May	13.347	13.599	60.131	56.494	63.560	64.313
June	13.399	13.656	59.899	56.778	63.369	64.591
July	13.946	13.924	61.467	57.864	65.750	65.625
August	14.490	14.174	61.613	58.857	68.169	66.857
September	14.376	14.062	61.886	58.705	67.693	66.528
October	14.300	13.862	61.977	58.304	67.523	66.298
November	14.353	.....	61.280	.....	67.893	.....
December	13.866	.....	59.540	.....	65.625	.....
Year	14.042	.....	61.920	.....	66.804	.....

New York quotations, cents per pound. London, pounds sterling per long ton.

Lead

	New York		St. Louis		London		
	1925	1926	1925	1926	1925	1926	1926 3 M
January	10.169	9.255	9.953	9.102	41.443	34.778	34.584
February	9.428	9.154	9.126	8.991	37.944	33.903	33.903
March	8.914	8.386	8.578	8.165	36.804	31.625	31.921
April	8.005	7.971	7.662	7.764	32.791	28.775	29.284
May	7.985	7.751	7.780	7.538	32.283	28.253	28.731
June	8.321	8.033	8.024	7.876	33.479	29.986	30.142
July	8.151	8.499	8.054	8.383	34.698	31.716	31.545
August	9.192	8.908	9.284	8.722	38.188	32.756	32.345
September	9.508	8.785	9.303	8.515	38.884	32.085	31.790
October	9.513	8.402	9.299	8.130	39.017	30.821	30.702
November	9.739	.....	9.578	.....	36.872	.....	.....
December	9.310	.....	9.157	.....	34.739	.....	.....
Year	9.020	.....	8.817	.....	36.429	.....	.....

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Tin

	New York 99%		New York Straits		London	
	1925	1926	1925	1926	1925	1926
January	57.692	61.415	58.250	2.275	265.560	282.038
February	56.517	62.653	57.068	63.705	262.181	287.107
March	53.038	63.472	53.733	64.505	245.682	292.288
April	51.380	61.962	52.135	63.389	237.006	281.388
May	53.675	60.165	54.620	62.305	245.476	270.125
June	54.885	58.409	55.957	60.611	252.476	268.352
July	56.683	61.365	58.014	63.091	258.435	282.102
August	56.649	63.875	58.190	65.260	258.538	293.690
September	56.405	66.535	58.247	68.895	259.182	306.273
October	60.462	68.225	62.274	70.245	277.722	312.548
November	62.136	.....	63.304	.....	284.506	.....
December	61.952	.....	62.928	.....	284.920	.....
Year	56.790	.....	57.893	.....	260.974	.....

New York quotations, cents per pound. London, pounds sterling per long ton.

Zinc

	St. Louis		London		
	1925	1926	1925 Spot	1926	1926 3 M
January	7.738	8.304	37.917	38.059	37.363
February	7.480	7.759	36.528	36.053	35.956
March	7.319	7.332	35.741	34.090	34.247
April	6.985	7.001	34.644	32.503	32.863
May	6.951	6.821	34.223	32.038	32.413
June	6.990	7.112	34.149	33.244	33.398
July	7.206	7.411	34.894	34.045	34.270
August	7.576	7.376	36.691	34.173	34.524
September	7.753	7.413	37.435	34.389	34.415
October	8.282	7.296	39.884	34.256	34.146
November	8.614	.....	39.039	.....	.....
December	8.565	.....	38.327	.....	.....
Year	7.622	.....	36.624	.....	.....

St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Antimony, Quicksilver and Platinum

	Antimony (a) New York		Quicksilver (b) New York		Platinum (c) Refined New York		Platinum (c) Crude New York
	1925	1926	1925	1926	1925	1926	1926
January	17.428	23.490	81.596	87.960	117.000	118.200	113.20
February	19.795	21.676	79.386	87.580	117.000	113.909	108.341
March	15.553	19.708	80.481	88.194	117.000	112.000	106.278
April	12.553	17.462	82.327	89.769	118.269	111.538	103.731
May	15.770	12.170	81.360	91.365	119.850	108.960	102.900
June	16.500	11.106	83.154	91.346	120.000	111.000	106.615
July	17.779	14.490	83.077	90.163	120.000	114.692	109.000
August	17.683	15.957	82.317	89.260	120.000	116.000	108.692
September	17.143	15.325	81.730	91.425	120.000	116.840	108.600
October	18.029	13.943	83.856	97.260	120.000	112.240	106.000
November	20.000	.....	88.250	.....	120.000	.....	.....
December	21.692	.....	90.000	.....	120.000	.....	.....
Year	17.494	.....	83.128	.....	119.093	.....	.....

(a) Antimony quotations in cents per pound for ordinary brands. (b) Quicksilver in dollars per flask. (c) Platinum in dollars per ounce.

Pig Iron, Pittsburgh

	Bessemer		Basic		No. 2 Foundry	
	1925	1926	1925	1926	1925	1926
January	24.66	22.76	23.76	21.76	23.76	22.26
February	24.50	22.76	23.26	21.76	23.76	22.26
March	24.06	22.76	23.06	21.76	22.91	22.26
April	22.89	21.38	21.76	20.66	22.26	21.05
May	21.57	21.12	20.26	19.76	21.16	20.76
June	20.76	20.76	19.76	19.76	20.11	19.80
July	20.76	20.44	19.76	19.26	20.26	19.49
August	20.76	19.87	19.76	19.18	20.26	19.26
September	21.04	20.11	20.03	19.26	20.50	19.30
October	21.50	20.76	20.37	19.76	20.83	19.97
November	22.64	.....	21.58	.....	22.08	.....
December	22.76	.....	21.76	.....	22.26	.....
Year	22.33	.....	21.26	.....	21.68	.....

In dollars per long ton.

Monthly Crude Copper Output in Short Tons

Domestic

	1926 April	May	June	July	August	Sept.
Alaska shipments	3,597	1,797	4,059	2,838	3,093	2,078
Butte & Superior	.....	.....	892†	.....	.....	.....
Calumet & Arizona	1,938	2,454	2,104	1,666	1,960	1,793
Magma	1,200	1,228	1,208	1,345	1,315	1,211
Miami	2,302	2,298	2,241	2,200	2,447	2,251
New Cornelia	3,634	2,723	3,543	3,466	3,194	3,292
Nevada Con.	.....	.....	27,539†	.....	.....	.....
Old Dominion	1,132	1,173	1,058	985	1,350	797
Phelps Dodge	7,033	7,566	6,786	6,775	6,723	5,866
United Verde Extension	1,730	1,997	1,908	1,738	1,765	1,756
Utah Copper	.....	.....	26,890†	.....	.....	.....
Tennessee Copper	520	555	521	543	511	499

Foreign

Boleo, Mexico	910	935	1,008	1,106	1,124	898
Furukawa, Japan	1,708	1,513	1,323	1,526	1,550	.....
Granby Cons., Canada	1,583	1,700	1,390	1,777	1,805	.....
Union Minière, Africa	7,050	7,547	7,294	7,716	8,188	7,623
Mount Lyell, Aust.	.....	.....	1,695†	.....	.....	†2,182
Sumitomo, Japan	.....	1,219	1,364	1,498	1,396	.....
Bwana M'Kubwa	.....	.....	.....	.....	.....	195

†Three months.

Monthly Production of Primary Copper from U. S. Mines and Daily Rate (Short Tons)

	1924 Monthly Production	1924 Daily Rate	1925 Monthly Production	1925 Daily Rate	1926 Monthly Production	1926 Daily Rate
January	66,631	2,149	74,789	2,412	71,026	2,291
February	65,681	2,265	68,967	2,463	68,131	2,433
March	65,181	2,102	74,901	2,416	75,728	2,443
April	66,073	2,202	70,667	2,356	73,454	2,448
May	65,608	2,116	70,574	2,276	73,542	2,372
June	63,933	2,131	59,894	2,330	71,317	2,377
July	64,787	2,090	68,507	2,210	72,228	2,330
August	66,756	2,153	68,090	2,196	72,014	2,323
September	63,800	2,127	67,720	2,272	71,777	2,393
October	68,989	2,225	71,042	2,292	.....	.....
November	68,291	2,276	67,400	2,247	.....	.....
December	67,647	2,182	69,566	2,244	.....	.....
Total	793,377	.....	842,117	.....	649,217	.....
Monthly average	66,115	.....	70,176	.....	72,135	.....
Average of daily rate	.....	2,168	.....	2,307	.....	2,378

Company Reports

Burma Mines Working Profit £335,243

Profits of the Burma Corporation, mining and smelting lead and silver in Upper Burma, excluding taxes and depreciation, were £335,243 for the second quarter of the year.

The following table shows shipments to the reduction works:

	Tons	Average Grade			
		Ag, Oz.	Pb, Per Cent	Zn, Per Cent	Cu, Per Cent
Concentrating ore to mill	73,216	18.37	20.32	13.96	0.96
High-grade ore to smelter	4,154	32.10	36.66	20.19	0.59
Total lead ore	77,370	19.10	21.19	14.29	0.94
Copper ore to smelter	11,362	19.48	14.11	9.18	7.32
Grand total	88,732	19.15	20.37	13.63	1.75

Production data include:

71,800 tons of ore were milled, averaging 18.2 oz. of silver, 20.2 per cent lead and 13.9 per cent zinc.

25,106 tons of lead, concentrates were produced, averaging 41.4 oz. of silver, 48.6 per cent lead, and 14.6 per cent zinc.

12,970 tons of zinc concentrate were produced in the experimental plant, averaging 12.9 oz. of silver, 6.9 per cent lead and 46.7 per cent zinc.

30,379 tons of lead-bearing material, including 4,835 tons of high-grade ore, were smelted for a production of 12,879 tons of hard lead, assaying 89.67 oz. of silver per ton.

13,136 tons refined lead and 1,277,103 oz. refined silver were produced.

2,660 tons copper matte, assaying 51.7 oz. silver, 21.1 per cent lead, and 41.8 per cent copper were also produced and shipped from the treatment of accumulated smelter by-products and 12,527 tons of copper ore.

Estimated revenue and expenditure were:

Estimated gross revenue	£831,458
Estimated operating expenditure	496,215
Estimated surplus over working expenditure	£335,243
Estimated income tax and super tax	£55,755
Estimated depreciation on machinery and plant	56,445
Capital expenditure	£61,371

The circular shaft was 939 ft. at the end of June, and all masonry and steel-work completed to that depth, which is 11 ft. below the No. 8 level plat, the cutting of which is being done.

The west crosscut 928 ft. south (No. 8 level) intersected the Chinaman Orebody 62½ ft. wide averaging 23.8 oz. silver, 34.4 per cent lead, 16.4 per cent zinc. The preparation for stoping of sections within the fire area is progressing steadily, about 25 per cent of the tonnage mined being derived therefrom.

Strength and Weakness of the Steel Cartel

The organizers of the European Steel Cartel were wise in not attempting to bind their constituent works to any scale of prices, according to *The Ironmonger* of London. The desired effect is expected to be obtained by the pooling system which has been adopted. The works included in the combine, it is stated, will pay a contribution of $1 per ton of their production. A yearly account will be taken, and those works that have produced more than their allotted tonnage will have to pay a fine of $4 into the pool on each ton made in excess of the quota. Those that have produced less than their allocation will be paid $2 for each ton that they have fallen below their allotment. The annual production of the cartel has been fixed at 27,528,000 tons, and it is estimated that this will be increased to 30,000,000 tons within five years. Of this amount, Germany's quota is 10,500,000 tons, France's 8,000,000, and the Belgians have secured an allocation of 295,000 tons per month.

The organizers of the cartel have been assisted by the coal strike in Great Britain, which has thrown practically the whole of the British demand for semi-finished material and a considerable proportion of the orders for finished steel usually given in this country into the hands of the Continental manufacturers. That has given a temporary appearance of prosperity to the Continental steel trade. It has always been recognized as a truism that it is easier to organize combinations of this description in good times than in bad, and the present occasion is no exception to the rule.

Although the negotiations were responsible for advancing the price of Continental steel material by several shillings, it is difficult to say how much of this was the result of the abnormal conditions of the market due to the coal strike in England. At any rate, there is no doubt that for the time being, higher prices must be expected, and already there are indications that this advance in quotations will be accompanied by a falling off in demand. The old position of a struggle between buyer and seller as to who can remain out of the market the longer threatens to reassert itself; and this fight will, in the end, show whether the cartel has been built upon a sufficiently strong foundation.

The new combine contains serious inherent weaknesses which are obvious to all who study the position. It is by no means certain that the German steel trade is as united as it appears to be. Certainly the German steel trust is in no position to control the German trade, as some of the most important works in Germany, including Krupps, Klockner, Mannesmann and Gutehoffnungshütte remain outside, and are expected to set up something in the nature of a rival organization. That may not affect the adherence of the German works to the European cartel; but it certainly does not make for strength. In the case of both France and Belgium, a national organization of steel works is almost non-existent, and whether it is possible to maintain an international organization in the absence of any national body which may speak for its members remains to be seen. Perhaps, however, the most serious weakness of the cartel is that the Belgian makers have joined reluctantly and that their adhesion was only obtained by persuasion, threats and bribery in the shape of a disproportionate tonnage allocation.

American Metal Earns $2,098,881

The American Metal Co., operating mines and smelters in the United States, Mexico, and Cuba, for nine months ended Sept. 30, 1926, shows a net profit of $2,098,881 after federal taxes, depreciation and reserves. This compares with $3,040,173 in first nine months of 1925. Net profit for third quarter of 1926 totaled $705,728, compared with $690,485 in the preceding quarter and $1,206,547 in the third quarter of 1925.

New Jersey Zinc Maintains Earnings

The New Jersey Zinc Co. reports for the quarter ended Sept. 30, 1926, net income of $1,673,823 after taxes, depreciation and depletion. This compares with $1,607,538, in the preceding quarter and $1,758,426 in the September quarter of 1925. Net income for the first nine months of 1926 totaled $4,965,257 against $4,969,761 in same period of the previous year.

Magma Copper Nine Months' Net $1,347,773

Magma Copper Co., operating at Superior, Ariz., reports for the quarter ended Sept. 30, net earnings of $504,076 before depreciation and federal taxes, comparing with $420,871 in the preceding quarter and $503,378 in the third quarter of 1925. Net earnings for the first nine months of 1926 totaled $1,347,773 before these charges, against $1.491,756 in the same period of the previous year.

During the three months ended Sept. 30, the company produced 7,742,113 lb. of copper at a book cost of 7.67c. a pound before depreciation and federal taxes and with gold and silver credited to copper. The average price obtained for copper during the quarter was 14.176c.

American Z., L. & S. Profits Higher

The American Zinc, Lead & Smelting Co., operating mines in Tennessee and Montana, and smelters in the Middle West, reports for the quarter ended Sept. 30, 1926, operating profit of $152,137 before depreciation and depletion, comparing with $112,843 in the preceding quarter and $66,620 in the third quarter of 1925. Operating profit for the first nine months of 1926 amounted to $382,988 before depreciation and depletion, against $367,149 in the same period of the previous year.

Tonopah Mining's Six Months' Earnings $180,641

The Tonopah Mining Co., of Nevada, reports for the six months ended June 30, 1926, a profit of $180,641 after expenses, but including a profit of $12,394 from sale of securities. This compares with $183,978 in the first half of 1925.

Mining Stocks—Week Ended October 30, 1926

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Anaconda	New York	47⅞	47¼	47⅜	Oc.16, No.22 Q	0.75
Arcadian Consol.	Boston	*95	*90	*90		
Ariz. Com'l.	Boston	10⅜	10	10⅜	Jy. 16, Jy. 30	0.50
Calaveras	N. Y. Curb	1¼	1¼	1¼		
Calumet & Arizona	New York	67½	65½	66¾	Se. 4, Se. 20 Q	1.50
Calumet & Hecla	Boston	17	16	16	Au.31, Se.15	0.50
Cerro de Pasco	New York	62⅝	61⅜	61⅜	Jy. 15, Au.2, Q	1.00
Chile Copper	New York	32⅞	31⅝	31⅞	De.1, De.27, Q	0.62½
Con. Coppermines	N. Y. Curb	3¼	2⅝	3		
Copper Range	Boston	15	14⅝	14⅞	May, 1925	1.00
Crystal Copper	Boston Curb	*35	*31	*33		
East Butte	Boston	2⅜	2½	2½	Dec., 1919	0.50
First National	Boston Curb	....	....	*5	Feb., 1919	0.15
Franklin	Boston	....	....	*40		
Granby Consol.	New York	....	....	31½	May, 1919	1.25
Greene-Cananea	New York	20	19½	20	Nov., 1920	0.50
Hancock	Boston	*50	*50	*50		
Howe Sound	New York	42⅜	41½	42	Oc.1, Oc.15 Q	1.00
Inspiration Consl.	New York	26	25⅜	25⅝	Se.16, Oc.4, Q	0.50
Iron Cap	Boston Curb	....	....	3½		
Isle Royale	Boston	11⅞	11⅞	11⅞	Jn. 1, Jn. 15	0.50
Jerome Verde Dev.	N. Y. Curb	....	....	*45		
Kennecott	New York	61⅞	60½	61½	Sept. 3, Oct. 1 Q	1.00
Lake Copper	Boston	*80	*60	*80	June, 1925	0.50
Magma Copper	New York	36	35½	35½	Oc.1,Oc.15,Q	0.75
Mason Valley	N. Y. Curb	2½	2	2½		
Mass Consolidated	Boston	....	....	*30	Nov., 1917	1.00
Miami Copper	New York	17½	17	17⅛	No.1, No.15 Q	0.37½
Mohawk	Boston	45	42	42½	Oc.30, De.1 Q	2.00
Mother Lode Coa.	New York	5¼	5¼	5¼	Jn. 15, Jn. 30	0.37½
Nevada Consol.	New York	15½	15	15⅜	Oc.14, Nov.16 Q	0.25
New Cornelia	Boston	23⅛	23	23⅛	No.5, No.22 Q	0.50
Noranda	N. Y. Curb	19¼	18⅜	19⅜		
North Butte	Boston	3	2⅞	3	Oct., 1918	0.25
Ohio Copper	N. Y. Curb	*43	*42	*42	Se. 1, Se. 15	0.05
Old Dominion	Boston	16	16	16	Dec., 1918	1.00
Phelps Dodge	Open Mar.	†134	†130	....	Se.25, Oc.2 Q	1.50
Quincy	Boston	18⅜	18	18⅜	Mar., 1920	1.00
Ray Consolidated	New York	15½	15⅜	15⅝	Ap.20, Ap.30	0.25
Ray Hercules	N. Y. Curb	....	....	11⅞		
St. Mary's Min. Ld.	Boston	27	26⅜	26⅝	Ap.17, My.18	2.00
Seneca Copper	New York	4⅛	3⅞	4		
Shannon	Boston	*35	*35	*35	Nov., 1917	0.25
Shattuck-Denn	Boston Curb	5⅛	5⅛	5⅞		
Superior & Boston	Boston	....	....	*35		
Tenn. C. & C.	New York	11⅞	10⅞	11⅝	Au.31, Se.15, Q	0.25
United Verde Ex.	N. Y. Curb	25⅛	25	25⅛	Oc.16, No. 1, Q	0.75
Utah Copper	New York	106⅜	106⅛	106⅜	Se.3, Se.17 Q	1.75
Utah Metal & T.	Boston	1 1/16	1 1/16	1⅛	Dec., 1917	0.30
Victoria	Boston	....	....	*50		
Walker Mining	Salt Lake	*65	*64	*65		
NICKEL-COPPER						
Internat. Nickel	New York	36⅜	34⅜	36	Se.7, Se.30, Q	0.50
Internat. Nickel, pfd.	New York	....	....	103	Oc.14, No.1,	1.50
LEAD						
Gladstone Mtn.	Spokane	*29	*28½	*29	Oct., 1926	0.01
National Lead	New York	148¾	148¾	148¾	Sept., 1926 Q	2.00
National Lead pfd.	New York	116	116	116	No.19, De.15 Q	1.75
St. Joseph Lead	New York	40⅛	39	40⅛	Sept., 1926 QX	0.75
ZINC						
Am. Z. L. & S.	New York	7¼	6⅞	7	May., 1917	1.00
Am. Z. L. & S, pfd.	New York	33⅛	30⅛	33⅜	Nov., 1920	1.50
Butte C. & Z.	New York	4⅞	4⅝	4⅝	De.10, De.24	0.50
Butte & Superior	New York	12⅞	12	12⅛	Se.15, Se.30 Q	0.50
Callahan Zn-Ld.	New York	1⅜	1⅜	1⅜	Dec., 1920	0.50
Eagle-Picher	Cincinnati	29¼	29⅛	29¼	Au.14,Se.1 Q	0.40
Eagle-Picher, pfd.	Cincinnati	....	....	110	Se. 30, Oc. 5 Q	1.50
New Jersey Zn.	N. Y. Curb	....	....	191	No.20, De.10 X	2.00
United Zinc	N. Y. Curb	....	....	*70		
Yellow Pine	Los Angeles	*26	*15	*15	Dec. 1925 Q	0.04
GOLD						
Alaska Juneau	New York	1	1	1		
Argonaut	Toronto	*67	*56	*59		
Barry-Hollinger	Toronto	*88	*79	*87		
Carson Hill	Boston	....	....	21½		
Consol. W. Dome L.	Toronto	*25	*23½	*24½		
Cresson Consol. G.	N. Y. Curb	2⅞	2¼	2¼	Oct, 1926	0.10
Crown Reserve	Toronto	*11	*9	*11	Jan., 1917	0.05
Dome Mines	New York	10⅞	9⅞	10⅜	Se.20,Oc.30,Q	0.50
Golden Center	N. Y. Curb	2⅛	1⅞	2⅛		
Golden Cycle	Colo Spring	....	....	2	No.30, De.10 Q	0.04
Hollinger Consol.	Toronto	18.95	18.25	18.60	Oc.19, No.4 F	0.10
Homestake Mining	New York	62	62	62	Oc.20,Oc.25 M	0.50
Kirkland Lake	Toronto	*96	*80	*80		
Lake Shore	Toronto	14.25	13.80	14.05	No.1, De.15 Q	0.25
McIntyre-Porcupine	New York	24½	23⅝	24⅜	No.1, De.1 Q	0.25
Newray	Toronto	....	....	*42		
Night Hawk Pen.	Toronto	*5½	*5	*5		
Portland	N. Y. Curb	....	....	*43		
Rand Mines	New York	....	....	41½	Au.23–30Am.Sh.	1.52
Teck-Hughes	Toronto	5.00	4.89	4.93	Jy. 15, Au. 2	0.05
Tom Reed	Los Angeles	....	....	*44	March, 1926	0.02
Tough-Oakes	Toronto	*59½	*50	*53		
United Eastern	N. Y. Curb	*46	*45	*45	July, 1924	0.05
Vipond Cons.	Toronto	1.75	1.65	1.67		
Wright-Hargreaves	Toronto	8.60	8.25	8.50	Se.15, Oc.1 QX	0.07½
Yukon-Alaska Trust	N. Y. Curb	....	....	20		
GOLD AND SILVER						
Carnegie Metals	Boston	12⅛	12	12⅛		
Con. Cortez	N. Y. Curb	*6	*3	*5		
Con. Virginia	San Francisco	*7½	*4½	*7½		
Continental Mines	N. Y. Curb	....	....	*48		
Dolores Esperanza	N. Y. Curb	....	....	*50	July, 1923	0.05
Premier Gold	N. Y. Curb	1⅞	1 1/16	1⅞	Se.15, Oc.4 Q	0.08
Tonopah Belmont	N. Y. Curb	....	....	2 1/16	Se.15, Oc.1	0.05
Tonopah Extension	N. Y. Curb	....	....	*34	Apr. 1925	0.05
Tonopah Mining	N. Y. Curb	3⅛	3⅛	3⅛	Se.30, Oc.27 SA	0.07½
Unity Gold	N. Y. Curb	....	....	*30		
West End Consol.	N. Y. Curb	....	....	*16	Mar., 1923	0.05
Yukon Gold	N. Y. Curb	....	....	*30	June, 1918	0.02

Stock	Exch.	High	Low	Last		Last Div.
SILVER						
Alvarado	N. Y. Curb	....	....	1	Oct., 1920	0.50
Beaver Consol.	Toronto	*70	*60	*61	May. 1920	0.03
Castle-Trethewey	Toronto	1.08	1.03	1.05		
Conagas	Toronto	4.35	4.35	4.35	May, 1924	0.12½
Keeley	Toronto	1.60	1.50	1.53	Se. 1, Se.15 SA	0.12
Kerr Lake	N. Y. Curb	*95	*80	*80	Oc. 1, Oc.15 SA	0.12½
La Rose	Toronto	*7	*6	*7	Apr., 1922	0.10½
Lorrain Trout Lake	Toronto	....	....	*35	Jy. 2, Jy. 15	0.05
McKinley-Dar.-Sav.	Toronto	*9	*9	*9	Oct., 1920	0.03
Mining Corp. Can.	Toronto	2.97	2.80	2.80	Jy.1, Jy.15 SA	0.12½
Nipissing	N. Y. Curb	5⅞	5	5⅞	Se.30, Oc.20 Q	0.15
Temiskaming	Toronto	....	....	*8	Jan., 1920	0.40
SILVER-LEAD						
Ahumada	New York	7	6½	6½	Se.28,Oc.1, QX	0.25
Alta Merger	Salt Lake	†*4	†*2	....		
Bingham Mines	Boston	35½	35½	35½	Se.20,Se.30 Q	1.00
Cardiff M. & M.	Salt Lake	*22	*20	*20	Nov., 1924	0.10
Chief Consol.	Salt Lake	2.70	2.70	2.70	De.15, Ja.2 Q	0.75
Consti'n Mng.&Mill'g	Spokane	*60	*60	*60		
Emma Silver	Salt Lake	†1	†*75	....		
Erupcion	Boston Curb	1¼	1⅛	1¼	Se.25, Oc.1, QX	0.10
Federal M. & S.	New York	....	....	87		
Federal M. & S., pfd.	New York	71	70	70½	Au.25, Se.15 Q	1.75
Hawthorne Mines	N. Y. Curb	*10	*8	*9		
Hecla Mining	N. Y. Curb	17	16⅞	17	Au.14, Se.15 Q	0.50
Highland-Surprise	Spokane	*22	*21	*21		
Iron King Mining	Salt Lake	*24	*19	*19		
Keystone Mining	Salt Lake	....	....	*26	Au.12, Au.26	0.07½
Lucky Jim	Spokane	*15⅜	*15	*15⅜		
Lucky-Tiger Com.	Kansas City	†7.25	†6.60	....	Oc.10, Oc.20 X	0.07
Mammoth Mining	Salt Lake	2.57½	2.55	2.55	Mar.24,Apr. 1	0.10
Marsh Mines	Spokane	3.50	3.00	3.37½	Se.15, Oc.19	0.15
Park Utah	New York	5.60	5.55	5.55	Se.15, Oc 1 Q	0.15
Plutus Mining	Salt Lake	....	....	2	Oct. 15, Q	0.15
Prince Cons.	Salt Lake	....	....	3		
Silver King Coal	Salt Lake	7.50	7.25	7.50	Se. 20, Oc.1, Q	0.25
Silversmith	Spokane	*38⅛	*37⅛	*38⅛	Oc.1, Oc.10 Q	0.02
Strattons Mines	Spokane	*42	*39	*42		
Tamarack-Custer	Spokane	*28¾	*25⅛	*28⅜	Sept., 1924	0.25
Tintic Standard	Salt Lake	....	....	10.62½	Se.13, Se.25 QX	0.40
Utah-Apex	Boston	5	4⅜	5	Oc.3, Oc.15 Q	0.25
Western Utah Copper	N. Y. Curb	....	....	*5		
IRON						
Bethlehem Steel	New York	46	44	44	July, 1924	1.25
Cleveland-Cliffs Iron	Cleveland	80	78	78	Oct., 1926	1.00
Colorado Fuel & Iron	New York	42	38⅛	39⅜	May, 1921	0.75
Gt. North'n Iron Ore	New York	....	....	19⅝	Dec., 1925	0.75
Inland Steel	New York	39	38	39	No.15, De.1 Q	0.62½
Mesabi Iron	N. Y. Curb	1⅛	1⅛	1⅛		
Replogle Steel	New York	8¼	8	8⅛		
Republic I. & S.	New York	56	54	55½	No.15, De.1 Q	1.00
Republic I. & S. pfd.	New York	....	....	96½	De.15, Ja.2 Q	1.75
Sloss-Sheffield S. & I.	New York	121	113½	118¼	Se.10, Se.20 Q	1.50
Sloss-Shef. S.&I. pfd.	New York	104¼	104¼	104¼	Se 20, Oc.1 Q	1.75
U. S. Steel	New York	142	137	138⅛	De.1, De.30 Q	1.75
U. S. Steel pfd.	New York	129½	129	129¼	No.2, No.29,Q	1.75
Virginia I. C. & C.	New York	48	47	47	Jan., 1924	1.50
Virginia I.C.&C.pfd	New York	....	....	72	Jn.1, July 2 SA	2.50
DIAMONDS, PLATINUM, ALUMINUM, VANADIUM						
De Beers Consol	New York	....	....	38⅜	Ju.16, Ju.17	1.70
So. Am. Gold & P.	N. Y. Curb	3⅞	3⅝	3⅞		
Alum. Co. of Amer.	N.Y. Curb	70	69	69		
Alum. Co. of Amer pf.	N.Y.Curb	....	....	102	Oct.1, Q,	1.50
Vanadium Corp.	New York	41	40	40⅞	De.1, De.15, X	1.00
ASBESTOS						
Asbestos Corp., New	Montreal	25⅜	22⅛	22⅞	Jan., 1926	1.50
Asbestos Corp., pfd.	Montreal	83	77¼	77¾	Jy.1, Jy.15, SA	1.75
SULPHUR						
Freeport Texas	New York	31⅝	28⅜	30⅜	Nov., 1919	1.00
Texas Gulf, new	New York	43⅜	39	43	Se.7, Se. 15, Q	3.00
MINING, SMELTING, REFINING AND GENERAL						
Amer. Metal	New York	46	44⅜	46	No.19, De. 1, Q	1.00
Amer. Metal pfd.	New York	....	....	114	No.20, De.1 Q	1.75
Amer. Sm. & Ref.	New York	132½	126⅜	129⅜	Oc.15, No.1, Q	2.00
Amer. Sm.&Ref.pfd.	New York	120	119½	119½	No.5, De.1, Q	1.75
Consol. M. & S.	N. Y. Curb	....	....	300	Jn.30, Jy.5 SAX	3.75
Federated Metals	N. Y. Curb	11	11	11		
Newmont Mining	N. Y. Curb	....	....	75	Oc.1, Oc.15, Q	0.60
Southwest Metals	N. Y. Curb	....	....	1		
U. S. Sm. R. & M.	New York	37⅞	31	31⅞	Oc.7, Oc.15, Q	0.87½
U. S. Sm. R.&M.pfd.	New York	44½	42	44	Oc.7, Oc.15, Q	0.87½

* Cents per share. † Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. F, four weeks. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Henry Sachs, Colorado Springs, Colo.

PRICE WEEK ENDED OCT. 19, 1926

Name	High	Low	Last		Last Divd. Date	Amount
Aramayo Mines (25 frs.)	80/—	77/9	78/9	Aug.	1926	15 p.c.†
British Platinum (£1)	4/6	3/—	4/—	Feb.	1925	2½ p.c.
Burma Corpn. (10 rupees)	15/3	14/7½	14/10½	Aug.	1926	7 annas*
Bwana M'Kubwa (5s)	7/10½	6/10½	7/6			
Camp Bird (2s)	4/—	2/6	2/9			
El Oro (£1)	6/—	5/—	5/9	Nov.	1924	2½ p.c.*
Esperanza (10s)	—/10½	—/9	—/9			
Frontino & Bolivia (£1)	8/9	8/6	8/6	July	1926	2½ p.c.
Mexican Corpn. (£1)	11/3	10/—	11/—			
Mexico Mines of El Oro (£1)	22/6	21/3	22/6	June	1926	7½ p.c.*
Oroville Dredging (£1)	3/—	2/6	3/—	Dec.	1923	3¾ p.c.
Ouro Preto (£1)	2/3	1/10½	2/—	May	1925	2½ p.c.
Rhodesian Congo Border (£1)	116/10½	112/6	112/6			
St. John del Rey (£1)	8/6	8/4½	8/6	June	1925	6¼ p.c.
San Francisco Mines (10s)	33/7½	32/1½	32/3	June	1926	15 p.c.
Santa Gertrudis (£1)	14/9	13/—	13/6	Oct.	1926	3¾ p.c.
Selukwe (2s. 6d.)	13/3	12/6	13/—	April	1917	6¾ p.c.
S. Amer. Copper (2s.)	4/6	3/7½	4/3	Nov.	1917	75 p.c.
Tanganyika (£1)	48/6	41/10½	45/—	Aug.	1926	7½ p.c.
Tomboy (£1)	4/—	3/7½	3/9	July	1926	10 p.c.
Union Miniere du Haut-Katanga (Brussels)	9.990	9.260	9.300	July	1926	175 (‡)

*Free of British income tax. † Swiss frs. ‡ Belgian frs. and free of taxation